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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JANUARY 26, 1899. CHICAGO, ILL. NUMBER 4

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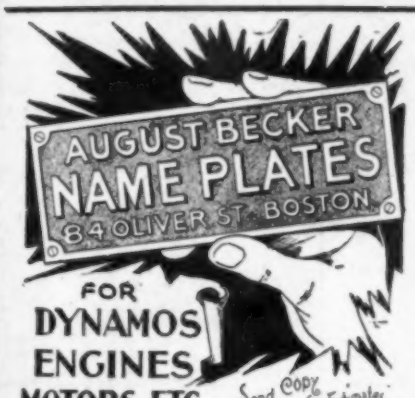

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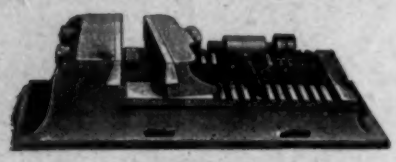

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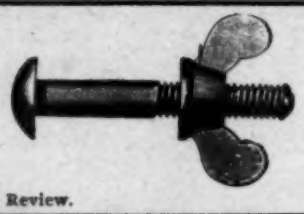

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JANUARY 26, 1899. CHICAGO, ILL. NUMBER 4

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Apart from persistent consolidation efforts, affecting particularly the steel billet and sheet bar supply in the Central West, the week has brought three important developments in iron circles: the announcement of prices for old-range Lake Superior Bessemer ores for 1899; the reported purchase by the American Tin Plate Co. from the leading Pittsburg interest of about one-third its sheet bar supply for a term of years; and an advance of 40 cents in freight rates on Southern iron to points north of the Ohio river, with corresponding advance in the delivered prices of those irons. The Bessemer ore price is 20 cents above the basis of 1898, or from $2.75 base to $2.95—a conservative advance in view of the rise of about $1.25 in Bessemer iron in the year. In connection with the purchase of sheet bars by the tin plate consolidation for a term of years, and reported arrangements with steel works formerly having connected tin plate plants, for most of the balance of its supply, the bearing of the effort to combine Central Western steel plants, as referred to in this column last week, is much talked of in the trade. The possibility of a sheet mill consolidation has been suggested, since bar and sheet mills would be the principal customers of steel plants having no connection with either the wire or tin plate consolidations. Further negotiations have been carried on, also, for the consolidation of the rolling mills of the Mahoning Valley. But in none of these deals has anything definite been brought to pass in the week. The billet and sheet bar markets have been inactive in view of the pendency of these matters which so vitally affect them. The quotation on billets is still $17 Pittsburg maker's mill Ordinarily considerable contracts in sheet bars have been closed at the first of the year; but little has been done this month, and the fact that sheet mills are not selling far ahead—60 days is the outside with most of them—indicates that that interest is under considerable tension. The situation in Southern pig iron has tightened further under a sudden jump of 40 cents in the freight rate to points north of the Ohio river. In the Chicago market the advance in Southern iron is 65 to 75 cents, or 25 to 35 cents over and above the added freight. In the same market local foundry iron was advanced 50 cents. In the Central Western districts, foundry iron has risen 25 to 50 cents a ton in the past 10 days, and in the view of the substantial element in the trade on the producing side is within 50 cents of a maximum line that should not be crossed. In finished materials prices are advancing in nearly all lines. Plates, bars and sheets are from $1 to $2 a ton higher in the week. In plates the price is what the buyer is willing to pay to secure the supply he wants within a given time. Old plate mills that have been inactive under low prices are getting in shape to start up. As high as 1.60c has been asked for tank steel in the week at Central Western mill. Steel bars have been advanced $2 by some mills and 1.10c Pittsburg is a common quotation. Complete returns from the mines to *The Iron Trade Review* show that the shipments of Lake Superior ores in 1898 were 14,029,682 tons. It is estimated that consumption in the coming year will be from 15,000,000 to 16,000,000 tons and that Lake Erie dock stocks will be drawn upon to supplement the production of the mines under the present supply of mining labor.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.* 705 PUBLICATION BUILDING, Jan 25.

There is some degree of recovery from the excitement in the local iron and steel market, as the new conditions of higher prices and scarcity of material become more familiar, but there is not a particle of abatement in the real strength of the conditions. The opinion is freely expressed that the present era of consolidation is to be followed by another era—of what sort is a matter of interesting speculation. The steel consolidation referred to a week ago is expected to be put through, though there is some question yet as to the exact scope of the operation. The advances in raw materials are being followed by increased firmness in finished lines, due no more to the strength in raw materials than to the heavy demand for finished material.

PIG IRON.—The market in Bessemer has been relatively quiet, the turnover being of small volume, but the valley furnacemen are strong in their position for $10.50. In Pittsburg little less than $11.15 can be done, although $11 has been mentioned. In gray forge there has been quite a fair buying movement in Pittsburg and the condition is approaching that in the valley, where mill iron is a very scarce article, and is all of $10. In Pittsburg we note a sale of a round lot for extended delivery at $9.75, but the general market is close to $10. In foundry iron the position is strong, with prices unchanged. We quote:

Bessemer, valley furnace	$10.50
Bessemer, Pittsburg	11.10 to 11.15
No. 1 Foundry	11.10 to 11.30
No. 2 Foundry	10.60 to 10.75
No. 3 Foundry	10.00 to 10.10
Gray Forge, valley furnace	10.00
Gray Forge, Pittsburg	9.85 to 10.00

STEEL BILLETS.—The condition is still one of considerable tension and the steel mills are in the majority of cases out of the market, except for an occasional lot which may fit in nicely. The quotation of $17, Pittsburg mill, is generally made, though $16.75 has been mentioned this week. In either case there is no guarantee that an order would be accepted at the figure. We note a sale at $17.25 for prompt steel, and middlemen who have what they consider desirable lots are holding for still higher prices. There is no rod market. In sheet bars there is considerable mystery surrounding the market, and while it is certain that the sheet mills must have bought a fair amount of steel, the transactions are not spoken of. We note a sale late last week at $18.25, maker's mill, Pittsburg, for a moderate sized lot, but this could scarcely be done this week. With consolidation talk at both ends, the market is pretty well tied up. Special interest attaches to the report that the American Tin Plate Co., in addition to the arrangement it is presumed to have made for bars, with New Castle and Wheeling district steel works whose tin plate plants it bought, has contracted for nearly one-third its requirements for five years with the leading Pittsburg producer.

PLATES.—The plate market is very firm. Mills are well sold up and are in an independent position. An order for a round lot could not be placed easily. The market is from $2 to $3 a

ton higher than it was three weeks ago. We now quote: Tank, 1.40c to 1.45c, shell, 1.50c; flange, 1.55c; fire-box, 2c and upward.

SHEETS.—The demand for both black and galvanized is very heavy. Orders are coming in freely and there is difficulty in filling specifications. Besides these conditions of strength, active work is being done in the trade looking toward a union of interest. With scarcely an exception mills will not sell for deliveries extending beyond two months. The quotation of 2c for No. 28 common is generally made, but some sellers can be found at 1.95c, at which the market is very firm. In galvanized there has been a further advance beyond the one noted last week, and to-day no sellers can be found below 80 and 5 off list, with a 15-cent freight allowance, while a number of producers are quoting 80 and 2½. The demand is very active and it is freely predicted that it will not be long until nothing better than 80 off can be done. This price is now being readily secured from small buyers.

SPELTER.—The spelter market has advanced materially and the metal cannot be had in Pittsburg under 5¼ cents, while St Louis is strong at about 5.15c. The heavy call for spelter for galvanized sheets will no doubt keep the metal in a strong position, outside of the usual influences.

IRON AND STEEL SKELP.—This market is very firm, with an excellent demand from pipe mills. We quote prices slightly higher, and it is probable that further advances will be made in the very near future. We quote: Grooved iron skelp, 1.10c to 1.15c; sheared iron skelp, 1.25c to 1.27½c; grooved steel skelp, 1c to 1.05c; sheared steel skelp, 1.15c to 1.20c.

FERRO-MANGANESE AND SPIEGEL.—There is no change to be reported in these lines. Domestic 80 per cent ferro is well maintained at $52.50 and spiegel is $23.50 to $24.

RAILS AND TRACK MATERIAL.—The rail market continues strong with no heavy movement, the mills being very well filled with orders. In track material there is a good demand with prices unchanged at $19 to $20 for standard sections. Track material while strong is still quoted as follows: Spikes, 1.45c; track bolts, 1.65c to 1.70c; splice bars, 1.10c to 1.15c; links and pins are quoted from 1.30c to 1.35c. A sale of 30,000 tons of rails for the Colorado, Texas & Mexico Road has been made in the week by the local mill.

PIPES AND TUBES.—There seems to be nothing known in the local market about the movement to consolidate the pipe mills of the country. It is probable that the work is being done quietly from New York. The market maintains a strong position and the mills are well satisfied with the condition of affairs at this time of year, when the market has usually been dull. We continue to quote: Additional discounts:—Five tens and seven and a half for less than carloads with an extra five for carloads; base discounts:—Butt weld, black, 55 per cent off; lap weld, black, 65 per cent off; butt weld, galvanized, 45 per cent off; lap weld, galvanized, 50 per cent off. Discounts on merchant boiler tubes are as follows: 2¼-inch and smaller, 72½ per cent off; 2½ inch and larger, 75 per cent off, with an extra 5 per cent to dealers. Inserted joint casing is quoted at 60 off and screw and socket joint casing at 60 and 10 per cent off, with an extra 2½ per cent to dealers.

STRUCTURAL MATERIAL.—There is prospect of considerable bridge building this summer as well as the erection of office and other large structures requiring steel. The market is strong at the recent advance in angles, tees and zees, and we quote as follows: Beams and channels, 3 to 15 inches, 1.30c; 18 to 24 inches, 1.40c; tees, 1.35c; zees, 1.30c, and angles, 1.20c.

OLD MATERIAL.—There is a good demand for old material and prices in some lines are a trifle stronger. We quote: Old steel rails, long lengths, $10.25; cut, $10.50 to $10.75; old iron rails, $14.25; wrought iron scrap, $11.50, net valley; cast borings, $6, net, valley; busheling scrap, $9, net; car wheels, $10.25, gross; cast scrap, $9, gross; iron axles, $6, net; steel axles, $12.50 gross; charcoal scrap, $10, gross; wrought turnings, $7.00, net, valley.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World*, 1512 MONADNOCK BLOCK, JAN. 25.

The market has gained additional strength in the week, prices of several products having been advanced. Sales have been good and in one or two lines have been large. The demand seems to be steadily increasing and the outlook is for a large business for the immediate future.

PIG IRON.—Quotations have been advanced again this week on both Northern and Southern irons. Freights from Southern furnaces have also been advanced 25 cents a ton to $3.35, and this, with an advance of 50 cents a ton in the furnace prices, puts Southern irons on a basis of $11.85 for No. 2 foundry, Chicago. The advance in freight rates takes effect shortly after the first of next month. Prices have been advanced on Northern iron 50 cents a ton to $11.50 for No. 2 foundry. Considerable sales were made before the advances went into effect, and some business has been done at the higher prices. The total sales for the week were quite a little in excess of those of the week previous. The demand is good, with prospects of continued sales, although the effect of the advances may be to make orders smaller for a short time. Higher prices still are talked of, and should the demand keep up in the way that seems likely, it is reasonable to believe the top of the market has not yet been reached. The present schedule of prices is given below, and in some cases furnaces have secured orders at higher figures than the minimum we give:

Lake Sup. Charcoal	$12 00 @ $13 00	Southern Coke No. 3	$11 60 @ 12 85
Local Coke Fdy. No. 1	12 00 @ 12 50	Southern No. 1 Soft	12 10 @ 12 60
Local Coke Fdy. No. 2	11 50 @ 12 00	Southern No. 2 Soft	11 85 @ 12 35
Local Coke Fdy. No. 3	11 00 @ 11 50	Southern Silveries	12 25 @ 12 75
Local Scotch Fdy. No. 1	12 00 @ 12 50	Jackson Co. Silveries	13 00 @ 14 50
Local Scotch Fdy. No. 2	11 50 @ 12 00	Ohio Strong Softeners	12 00 @ 12 50
Local Scotch Fdy. No. 3	11 00 @ 11 50	Alabama Car Wheel	15 50 @ 16 50
Southern Coke No. 1	12 10 @ 12 60	Malleable Bessemer	11 50 @ 12 00
Southern Coke No. 2	11 85 @ 12 35	Coke Bessemer	11 50 @ 12 00

BARS.—Sales last week were large, both in small and large lots. The demand is steady, and appears to be increasing somewhat with every week. The mills are firmer in their views, although no further advances have been made in prices. Common iron is selling at 1.10c to 1.20c, with a few mills asking even more than the higher figure. Guaranteed iron is quoted at 1.15c to 1.25c, and soft steel bars from billet stock at 1.10c to 1.15c.

RAILS AND TRACK SUPPLIES.—Small sales of standard sections were made in this market last week. Some good orders of light rails were taken. The market is firm at the quotations, which are as follows: Standard section rails, $20 to $22; light rails, $20 and upwards; steel splice bars, 1.15c to 1.25c; track bolts with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.55c to 1.60c.

BILLETS AND RODS.—No sales of either billets or rods were made last week by the local mills. Mills farther East secured a few small orders for rods. Billets continue to be quoted at $18.25 to $18.50 and rods at $25.

CAR ORDERS.—Car material continues in large demand, reflecting activity on the part of the car works. No especially large orders for cars were given out last week with the exception of one contract for 2,000 cars, placed with a Western car works by an Eastern road.

STRUCTURAL MATERIAL.—A good business was done in small lots last week and a few contracts were placed by bridge works. The contract for the Schlesinger & Mayer building, amounting to about 3,000 tons, has not yet been given out but will probably be placed this week. Armour & Co. will build a new power house taking 1,000 tons of material, contract for which will be let immediately. No other large contracts are in the market at present. A project is on foot to consolidate all the bridge works of the country, and it is thought if this deal goes through it will be closed in the near future. The matter is in the hands of Eastern men. Quotations are as follows: Beams, 15 inch and under, 1.45c to 1.50c; 18-inch and over, 1.55c to 1.60c; angles 1.35c to 1.40c; sheared plates 1.40c to 14.5c; universal plates 1.40c to 1.50c; tees 1.50c to 1.60c; zees 1.40c to 1.45c. Small lots from stock are quoted at ¼c to ½c higher.

PLATES.—There has been considerable business closed in the past week, the local mills having taken orders aggregating over 3,000 tons, and several orders having been placed for round lots with mills farther East. The demand is growing larger all the time. The market is very firm and local mills have advanced their prices to the basis of Eastern mills. Quotations are as follows: Tank plates, 1.40c to 1.50c; flange steel, 1.45c to 1.50c; marine, 1.70c to 1.80c; fire-box steel, 2.25c to 5c.

SHEETS.—The demand for both black and galvanized sheets has been good and several quite large contracts were closed

last week. Small order business also furnished a good aggregate tonnage. Quotations are made at 2c to 2.10c for black sheets, and 80 and 7½ per cent off for galvanized.

MERCHANT STEEL.—Considerable business was done last week in small lots and one or two quite large contracts were closed. In the present condition of the mills further large business is not being pushed for. Quotations follow: Open-hearth spring tire and machinery steel, 1.65c to 1.75c; smooth finished machinery steel, 1.60c to 1.70c; smooth finished tire, 1.50c to 1.60c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SCRAP.—There is a better demand for nearly every grade of scrap and good sales were made last week. Orders included one lot of 1,000 tons of old iron rails, and one of a considerable quantity of steel rails. Car wheels are improving and one quite large contract was placed last week. Dealers' selling prices are as follows:

Old iron rails, gross,	$13 00@$13 50	Axles, net	$14 50@$15 00
Old steel rails, long, gr.	10 50@ 11 00	Cast borings, net	4 25@ 4 50
Old steel rails, short	8 50@ 9 00	Wrought turnings, net	6 00@ 6 50
Old wheels, gross	11 75@ 12 25	Axle turnings, net	7 00@ 7 25
Railroad forge, net	11 75@ 12 25	Mixed steel, gross	6 50@ 7 00
Dealer's forge, net	9 50@ 10 00	Stove plates, net	5 75@ 6 00
No. 1 mill, net	7 25@ 8 00	Heavy melting steel, gr.	8 25@ 8 50
Heavy cast, net	8 50@ 9 00	Old iron splice b., net.	12 75@13 00
Malleable cast, net	8 00@ 8 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World*, 27 VINCENT ST., Jan. 25.

Prices on old-range Bessemer ores are being quoted to furnacemen this week, and it is probable that a large business will be closed within the next 10 days. Values are on a basis 20 cents above that of last year; that is to say, the supposititious ore containing .045 per cent phosphorus, 63 per cent iron and 10 per cent moisture, which carried a price of $2.75 last year is $2.95 this year. Norrie ore, which is so close to the base in its analysis that it has been sometimes mistakenly called the base, sells for $2.99½ this year, as against $2.84 last year. Thus each ore carries a price decided by its analysis, so that the advances are not uniform, the average content of iron and phosphorus varying somewhat from year to year. These calculations are so exact that the half cent appears in the price of half a dozen ores this year. Chapin, for example, that sold at $2.56 last year, is quoted $2.73½ this year. It would not be difficult for the sellers of certain well known ores to dispose quickly of practically all their properties are likely to produce in 1899; the probabilities are that in many cases the distribution of such ores in a way that will satisfy all who have been in the habit of using them will be the problem. The Federal Steel Co.'s formation takes out of the market in part a leading buyer of other years, though the company may be more of a buyer of ore than has been commonly supposed. With ore requirements of above 3,750,000 tons, and ability to use only about 1,500,000 tons of its Mesabi supply, counting 40 per cent of the whole, it would need 1,000,000 tons from the market even though it consumed all its Vermillion range product. The presumption is that some of the latter will either be sold in the market to old customers or traded for other ores. It would appear that very conservative counsels have prevailed in arriving at a basis for 1899 business in Bessemer ores. The advance made in Bessemer iron in the year is sufficient to cover the increase in ore two or three times over. Moreover, if the consideration of supply and demand were the only one, a higher price must have resulted, for all calculations of the consumption of Lake Superior ores in 1899 make it larger than the mines can produce without a substantial increase in the supply of mining labor. It is more thoroughly a self-supporting situation than the problem of Lake Superior ores has shown in years; and it is evident that the ore companies have been influenced largely by the conviction that low and stable prices must be maintained, to foster and increase the export trade. The Mesabi situation is showing itself less amenable to outside conditions than before. With a 20-cent advance in the old-range basis, the gap between these ores and the Mesabi product will be even wider, if the price named on a well known ore of that range is to set the pace. This is reported to be 5 cents above last year's price, with privilege of a contract over a term of years at the same figure. In non-Bessemer ores there have been some negotiations; and consumption is such that an advance over last year's price of from 10 to 20 cents is maintained without difficulty.

PIG IRON.—Foundry irons are higher and there is a steady run of business with Northern Ohio foundries. The advance in Southern freights, and an added advance on the iron has made Alabama iron from 50 to 65 cents higher in this market; but even on that basis very little can be had and this condition promises to continue for the next two months. Forge iron is practically out of the market, though $10 valley furnace is still quoted. There is no prospect of increasing the output, since ores cannot be had. In Bessemer the situation is unchanged. One valley furnace with ore arrangements for both Bessemer and basic in 1898, will go on to the latter exclusively. Though there has not been the same rate of shipments of Bessemer this month that was noted in December, owing to some steel works shut-downs, the consumption is again heavy and further considerable purchases in the Pittsburg district for the first half are expected. A fair business has been done in Lake Superior charcoal at firmer prices. We quote:

Bessemer	$11 15	Valley Scotch No. 1	$11 40@11 65
No. 1 Strong Foundry	$11 25@11 50	Valley Scotch No. 2	10 90@11 15
No. 2 Strong Foundry	10 75@11 00	Gray Forge, valley	10 00
No. 3 Foundry	10 50	Lake Superior Charcoal	11 50@12 00

FINISHED MATERIAL.—Sales of 2,000 tons of ship plates have been made in addition to those noted last week, and the market shows such tension that round lots, contrary to the general rule, command higher prices than smaller trade. The mills are making an effort to take care of the latter, and those not committed for months ahead to big orders will be fully occupied for an indefinite period, it would appear, with business coming up week by week. We quote 1.45c Pittsburg for tank, 1.50c to 1.55c for shell and 1.60c to 1.65c for flange. Sheets are about $1 a ton higher, and on large lots the usual Pittsburg minimum is 2.05c for No. 28. We quote No. 28 at 2.15c Cleveland and No. 27 at 2.05c. Steel bars are strong. Pittsburg mills quote 1.05c and 1.10c. The Cleveland market is 1.12½c to 1.15c. On bar iron the advance to 1.05c Cleveland noted a week ago is maintained. Beams and channels are quiet, apart from recent vessel work, though the prospect for spring demand is good. We quote Cleveland prices at 1.30c for angles and 1.40c for beams and channels. The wire and nail trade shows good activity at the advances made early in the month, the prospect of a further rise being some stimulus. The barbed wire trade promises a large spring business. We quote wire nails at $1.45, jobbing rate, $1.50 in car loads and $1.55 less than car loads. Smooth wire is $1.30 base, barbed wire, $1.55; galvanized, $1.90. No extended delivery sales are made.

OLD MATERIAL.—There is more firmness in some lines, in view of the advances in foundry iron and in gray forge. We quote No. 1 wrought scrap at $12; old iron rails at $14.25; old steel rails, $9.75; car wheels, $11; machinery cast scrap, $8.50 to $8.75; wrought turnings, $7; cast borings, $5.75; stove plate, $6.

CINCINNATI.

Jan. 24.

The great sensation of the week as far as Southern pig iron is concerned is the advance in freight rates south of the Ohio River, which has added 40 cents per ton to the recent rates. In other words, the freights effective in the boom days of '95 have been restored. From Birmingham to Chicago the rate previously was $3.10; it is now $3.50. To Cleveland it was $3.30; it is now $3.70. To Cincinnati it was $2.25; it is now $2.75, the rate to Cincinnati and to other points on the Ohio River being 50 cents in advance. Whether or not this tremendous rise in freights is going to stop the buying movement, which has been continuing with such force, is an open question. There is every probability that it will check it very suddenly, for it means that the buyer has in reality got to pay a very decided advance on previous quotations. The new freights go into effect on February 6, but have been made effective as far as future business is concerned on the 23rd of this month. Sales booked previous to that time of course are protected on the old rate. During the week there was quite a heavy tonnage placed, charcoal and special irons, however, having the preference. The Southern furnaces will be glad of a let-up in the buying, as probably they do not enjoy any more than their agents do the hard and stern necessity which has been their law recently in turning down offers from old customers. So the chances are that they are going to have a breathing spell, which will give them leisure to clear up back business. We quote f. o. b. Cincinnati: Southern coke, No. 1 foundry, $11.25 to $11.50; No. 2, $11 to $11.25; No. 3, $10.75 to $11; No. 4 and gray forge, $10.50; mottled, $10.25 to $10.50; No. 1 soft, $11.25 to $11.50; No. 2, $11 to $11.25; Hanging rock charcoal, No. 1, $15.50 to $16; Jackson Co. silvery, No. 1, $12.75 to $13; standard Georgia car wheel, $14.75 to $15.25.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER

JANUARY 26, 1899.

EACH week brings its yield of consolidation projects affecting the iron trade The proposal to bring the producers of cast iron pipe together has been up at intervals in the past eight or ten years, and in view of the backwardness of that industry in the midst of the general forward movement in iron products, the present time might not be thought inopportune by the owners of pipe works to get their more or less modern plants into certificate form for a campaign in Wall Street. There is undeniably a future for American cast iron pipe in the export trade, and to make the most of it a modern foundry located in the Birmingham district, taking advantage of the shipping facilities that are building up for the export pig iron trade of that district, and getting pig iron from neighboring furnaces, is a more attractive proposition than a home combination that shall include unfit plants with the fit. The wrought pipe and tube companies of the country are also named as objects of attention by New York promoters, but nothing tangible has been developed as yet. A third combine proposed is one of the bridge works of the country. A New York banking house that has figured in similar work in iron and steel lines, has made tentative proposals in connection with the project, a capital of $50,000,000 being proposed. These are not the only lines, however, in which promoters are busy. Manufacturers have come quite to expect overtures from promoting syndicates, so rapidly has the new method in industrial organization made its way. The tremendous pressure of accumulated money demanding investment in securities made attractive by the promise of minimum competition, is bringing about conditions that may well cause apprehension.

TRADE expansion will be the watchword of the convention of the National Association of Manufacturers in session at Cincinnati this week. And consistent with its action from the beginning, the association may be expected to declare again for a national policy of encouragement to American shipping, which is inseparable from such development of our foreign trade as the Nation is now a unit in demanding. Sentiment has been making rapidly for Government aid to ship-building and ship-owning in the year since the last convention of the manufacturers' association, and the Hanna and Payne bills only embody what the thought of the best minds of the country has been formulating since the naval battles at Manila and Santiago. Already the shipyards of the country are running over with work, in anticipation of a policy that will put our merchant shipping on the footing required by the new life on which the country has entered. In its recent exhibit of work on hand at the shipyards of the country the *Marine Review* shows an aggregate of 292 vessels valued at $62,110,092 building or under contract. In view of this showing and of the greater things yet to come the *Marine Review* says:

It is certainly a source of gratification to find that if we include some 58 naval vessels—a wonderful record in government orders—the ship yards of the country are now supplied with work sufficient to keep most of them, and especially the larger ones, actively engaged for the next three years. Several new ship building and engineering works of large proportions have been created within the past year. The Carnegie Steel Co. and other manufacturers of ship building material have made sales within the year of large quantities of steel plate for delivery to foreign ship builders. All of the large tool concerns have had their agents scouring the engineering works of Europe and their sales have been phenomenal in the ship yards, as well as in establishments generally where metal working tools are required. All this without any reference to the avowed policy of the present administration at Washington to provide adequate aid to American ships in the foreign trade in competition with aided foreign ships. There is certainly a grand future in store for the shipping interests of this country, if the beginning already made with the building of ships for our own trade is to be followed by the passage of the Hanna-Payne bill, now before Congress, and which will, if passed, result in the construction of two or three hundred thousand tons of new ships for the foreign trade at an expenditure of many millions of dollars during the next few years. Never before has there been such a union of the shipping, ship building, manufacturing and mercantile interests on a measure of this kind. It is undoubtedly the most thoroughly practical and equitable plan for accomplishing the end desired, and will, in all probability, meet with approval from the present Congress. Then look for a steady march of ship building progress in the United States.

American Comment on the Furnace Gas Engines at Seraing.

A brief letter to th eeditor from J. H Cremer, chemist and metallurgical engineer, of Cleveland, refers to the continued prosperity of iron and steel works on the Continent of Europe. All are busy and prices of coal, coke, pig iron and finished products are high. Mr. Cremer has spent the winter months in Europe for several years and has had opportunity to visit some of the prominent works in Belgium and in Luxemburg. This extract from his letter, which was written at Flanders early in the present month, will be read with interest by blast furnacemen and others:

"I saw at the John Cockerill Works (founded 1817) at Seraing, Liege, their large furnace gas engine—a fine engine of 500 h. p., running with extreme smoothness and steadiness, without any appreciable variation in speed. It takes the gas directly from the blast furnace main without any cleaning or washing. These have been found unnecessary, the practice being merely to pass the gas through ordinary large-sized dust-catchers. The engineer told me that the valves and cylinder were not affected by the dust, and no difficulty was met, in keeping all parts of the engine in good condition. The gas used came from furnaces making No. 1 Bessemer and was somewhat smoky. The thermal efficiency of the

engine is high, being rated at from 26 to 28 per cent. Judging from the results obtained at Seraing with blast furnace gas engines, it would be reasonable to believe that such engines are the coming blowing engines for furnaces."

American Steel and Wire Co.

The work of organization is being carried on as rapidly as possible by the promoters of the American Steel & Wire Co. At a meeting of the stockholders held in New York Tuesday, Jan. 24, the following directors were elected: Three-year term, J. W. Gates, I. L. Ellwood, William Edenborn, Henry Seligman, John Lambert; two-year term, S. H. Chisholm, F. P. Voorhees, W. P. Palmer, P. W. Moen, Frederick Strauss; one-year term, G. T. Oliver, F. M. Drake, C. T. Boynton, James Hopkins, C. C. Howard. The officers are to be chosen by a meeting of the directors appointed for Jan. 25. The only additional purchase announced in the week is that of the Indiana Wire Fence Co , Crawfordsville, Ind. At the meeting now in session in New York stock certificates are to be distributed, the new securities being issued Jan. 25. It is stated that the offering of $28,000,000 of the stock of the new company to underwriters brought out applications for $143,000,000.

At the annual meeting of the Cleveland Rolling Mill Co. at the offices of the company in Cleveland Jan. 18, the passing of control to the American Steel & Wire Co. was formally consummated. The new owners, who then had something over half the stock of the company, voted it for the following new organization: President, William Chisholm; vice-president, William P. Palmer; secretary, Thomas N. Taylor; treasurer, George C. Scott; directors, William Chisholm, Albert T. De Forest, Thomas H. Taylor, William P. Palmer, Isaac L. Elwood, William Edenborn. The above organization will remain until all the stock of the Cleveland Rolling Mill Co. is bought in. This may require some weeks, and when it is accomplished the corporate existence of the company will cease. The policy of the new owners has not developed as yet; but it is expected that as rapidly as may be, changes will be made which will concentrate production on the products which the American Steel & Wire Co. markets, eliminating bar, structural and other departments which have been operated by the Cleveland Rolling Mill Co. for so many years.

A. T. De Forest and Thos. H. Taylor, who appear in the directory above, are manager and assistant manager respectively of the Cleveland plants of the American Steel & Wire Co. It is expected that William P. Palmer, who is to be general manager of the new American Steel & Wire Co., will make his headquarters in Cleveland.

Virginia Furnace Combination.

The formation of the Virginia Iron, Coal & Coke Co , with $15,000,000 capital, half preferred and half common stock, is the outcome of the effort to bring together under one corporation the Virginia furnaces along the line of the Norfolk & Western railroad, except the Pulaski. The two Crozer furnaces at Roanoke are said to have been bought and in other cases options are about to be closed. The project is said to include besides the two stacks of the Crozer Iron Co., the furnace of the Dora Furnace Co., Pulaski, Va.; the furnace of the Virginia Development Co. at Buena Vista, Va., now under lease to F. C. Dinuiny, Jr.; the Gem Furnace of the Shenandoah Furnace Co. at Shenandoah, Va.; the Ivanhoe Furnace of the New River Mineral Co.; Max Meadows Furnace of the Max Meadows Iron Co.; the Bristol Furnace of the Home Iron Co.; the furnace of the Radford-Crane Iron Co. and the Graham and Salem furnaces of the Virginia Development Co. Apart from the Crozer, Dora, Ivanhoe and Buena Vista furnaces most of the above have been idle for some time. They were built in the period preceding 1890, when town lot schemes in the South were plentiful; and when these fell through the iron making end of the proposition had no vitality. It is difficult to understand, if the consolidation now proposed is seriously put forward as an iron-manufacturing company, where the ore supply is to come from for additional stacks. There is but one developed company in Southwest Virginia that has plenty of ore in sight. There is other ore, and in quantity, but it is scattered all over that end of the State. As it is, it requires sharp work getting together enough to keep in blast the furnaces that are going. If new capital comes in, one of the first expenditures necessary will be for the development of ore properties.

PERSONAL.

J. H. Parks, of Boston, well known as the chief promoter of the wire nail and bolt and nut pools of 1896, is a prime mover in the movement for the amalgamation of Western flint glass interests, with the aid of British capital.

An official circular issued by the Illinois Steel Co. makes the following announcements, most of which have been noted in these columns heretofore: Eugene J. Buffington has been elected president, vice J. W. Gates, resigned. Wm. P. Palmer has resigned as second vice-president. T. J. Hyman has been elected secretary, vice W. A. Green, resigned. A. M. Crane has resigned as general sales agent, and the sales department will, until further notice, be in charge of Geo. Baker, assistant general sales agent. C. A. Honecker has resigned as cashier.

H. E. Tener, Jr., formerly chief of the shipping department of the Carnegie Steel Co., Ltd., has been made general agent of the order and shipping department. W. B. Dickson has been appointed assistant general agent.

C. W. Bray, who has just been elected assistant general manager of the Ætna-Standard Iron & Steel Co., of Bridgeport, O., was formerly president of the Beaver Tin Plate Co., Lisbon, O. Isaac M. Scott, who has been made secretary of the Ætna-Standard company, was secretary and treasurer of the Beaver Tin Plate Co.

W. C. Coffin, manager of the New York offices of the Riter-Conley Mfg. Co., of Pittsburg, has returned from a trip to Europe.

John W. Gates, New York papers say, will be made president of the new American Steel & Wire Co. President Lambert of the old American Steel & Wire Co. has been urged by Chicago financial columns as the choice of prominent interests. The probabilities are that Mr. Gates will be chairman of the new company, as he is of the old, and that Mr. Lambert will be the executive head. A meeting for organization is being held in New York this week.

Manager Wallace of the New York office of the Cleveland City Forge & Iron Co., is to go to London to establish there a European agency of the company.

A FIRE test was made in Pittsburg last week of some sheet metal sash and window frames, the sash containing glass in which metal was imbedded. The frames were built into a small brick house, erected for the purpose, and a large fire maintained against them. The frames and sash stood the test remarkably well.

A BERLIN trade note says that German works, notwithstanding the excellent outlook, will be careful about advancing prices, on account of foreign competition which they are anxious not to increase. Trade papers there refer to an expected influx of American steel.

AT a banquet to Mayor Diehl at Buffalo, Saturday night, Jan. 21, $427,000 was subscribed for the Pan-American Exposition to be held at Niagara. A fund of $500,000 is promised, and with that to start on a committee of 25 will go to Washington to work for a Government appropriation.

THE latest catalogue of the Scioto Star Fire Brick Works, of Portsmouth, O., is an attractive piece of trade literature, printed in red and black. The works of the company are located at East Portsmouth, and besides the river have shipping outlets over three railroads The capacity is 9,000,000 a year of high grade fire brick. Emphasis is put, in the catalogue, upon the large list of 9-in and 13½-inch shapes kept in stock, and illustrations are given of the various shapes and numbers manufactured. The company owns 1,500 acres of clay lands.

A DIVIDEND of $1 a share has been declared by the Republic Iron Co. No change was made at the annual meeting in either officers or directors. Recent sales of stock are reported at 12 and 12½. The mine, which is one of the oldest on the Marquette range, has been making a steady output of between 125,000 and 150,000 tons a year for several years.

14,029,682 TONS.

LAKE SUPERIOR IRON ORE OUTPUT IN 1898.

We present below our annual statement of the shipments of Lake Superior ores, mine by mine. The total for 1898 is 14,029,682 gross tons, as compared with 12,469,638 tons in 1897, 9 934,446 tons in 1896, and 10,429,037 tons in 1895. There were 69 shipping mines and groups of mines in 1898. In 1897 the number was 78; in 1896, 84; in 1895, 86. These figures do not strictly represent the number of individual mines. In the Marquette range, for example, the Cleveland-Cliffs Iron Co.'s name stands for six properties—Cleveland Hard Ore, Cleveland Lake, Cliffs Shaft, Salisbury, Foster and Tilden. The Lake Superior group on the Mesabi stands for three mines—Hull, Burt and Rust. Similarly the Norrie, the Lake Superior (Marquette range), Franklin, Oliver, Penn Iron Mining Co. and Minnesota stand for two or three mines each:

MARQUETTE RANGE.

MINE.	GROSS TONS.
Cambria	102,623
Champion	163,190
Cleveland Cliffs	869,482
Jackson	55,012
Lake Angeline	460,333
Lake Superior	686,563
Lillie	211,023
Lucy	11,846
Negaunee	191,330
Princeton	25,247
Queen	61,022
Republic	140,312
Richmond	24,464
Winthrop	122.592
Total	3,125,039

MENOMINEE RANGE.

Antoine	104,510
Aragon	295,821
Chapin	724,768
Columbia	14,199
Commonwealth	250,687
Crystal Falls	128,233
Cundy	76,877
Dober	5,009
Dunn	49,381
Florence	93,663
Great Western	33,851
Hemlock	69,865
Loretto	68,447
Mansfield	60,739
Mastodon	5,009
Millie	17,430
Penn Iron Mining Co.	223,713
Pewabic	305,072
Total	2,527,274

GOGEBIC RANGE.

Anvil	5,037
Ashland	123,208
Atlantic	38,058
Aurora	133,076
Brotherton	73,198
Cary	43,162
Colby	152,875
Iron Belt	58,418
Montreal	270,776
Newport	196,953
Norrie	700,990
Pabst	223,891
Palms	175,925
Shores	15,691
Tilden	287,203
Total	2,498,461

VERMILLION RANGE.

Chandler	715,919
Minnesota	426,040
Pioneer	123,183
Total	1,265,142

MESABI RANGE.

Adams	390,860
Auburn	235,630
Biwabik	383,180
Commodore	80.494
Day	18,65 1
Duluth	112,155
Elba	564
Fayal	575,933
Franklin	200,400
Genoa	279,677
Lake Superior Group	135,404
Mahoning	520,751
Mountain Iron	650,955
Norman	110,141
Ohio	101,607
Oliver	349,100
Penobscot	29,652
Pillsbury	99,691
Sellers	112,765
Sparta	226,156
Total	4,613,766

The tables below show the distribution of the shipments for 1898 by ranges and by ports, together with the all-rail shipments. The latter were 374,250 tons last year, an increase of about 120,000 tons over 1897. Much of this ore went to South Chicago and Bay View early in the year; the balance was shipped to Lake Superior charcoal furnaces. The Marquette range comes next to the Mesabi, as in 1897. For the first time since the Gogebic range became a producer on any scale, 12 years ago, the Menominee range exceeds it in output, although with the larger working of the Norrie and the Tilden by the Oliver interest it was supposed the Gogebic would even increase its lead in 1898. It will be seen that the Menominee range, with the big Chapin as a chief dependence, has made a large gain over its record of 1897:

SHIPMENTS BY RANGES

	1897 Gross Tons.	1898 Gross Tons.
Marquette Range	2,715,035	3,125,039
Menominee Range	1,937,013	2,527,274
Gogebic Range	2,258,236	2,498,461
Vermilion Range	1,278.481	1,265,142
Mesabi Range	4,280,873	4,613,766
Total	12,469,638	14,029,682

SHIPMENTS BY PORTS AND ALL-RAIL.

	1897 Gross Tons.	1898 Gross Tons.
Escanaba	2,302,121	2,803,513
Marquette	1,945 519	2,245,965
Ashland	2,067,637	2,391,088
Two Harbors	2,651,465	2,693,245
Gladstone	341.014	335,956
Superior	531,825	550,403
Duluth	2,376,064	2,635,262
All-Rail	253,993	374.250
Total	12.469.638	14,029,682

With our issue of next week we will publish our annual ore supplement. It will give the iron ore shipments from Lake Superior for 1898 and the preceding 43 years, by ranges and by mines.

The Alcania Co's Tin Plate Plant.

The Totten & Hogg Iron & Steel Foundry Co., of Pittsburg, manufacturer of rolling mill engines, rolling mill machinery and rolls, has lately received an order to build a tin mill for the Alcania Co. at Avonmore, Pa.; also an order from the J. C. Russell Shovel Co. for an 18-inch special train of rolls for rolling shovel blanks.

30,000-Ton Rail Order for Texas.

The Colorado, Texas & Mexico Railroad Co. has placed an order with the Carnegie Steel Co. for 30,000 tons of 70-pound rails, to be used in laying 200 miles of track from Llano to Haskell, Tex. The order included the usual fastenings.

IT is reported that $4.000 000 was the consideration for which the Lackawanna Iron & Steel Co. recently sold its Pine Brook and Capouse collieries and the coal lands belonging to them to a company headed by Joseph Dickson, of New York, which will do business under the title the Scranton Coal Co.

THE Morgan Engineering Co., Alliance, O., makes the following announcement: "We have found it expedient and to the advantage of our customers to sell our product direct and not through agencies. We have therefore terminated the agreement existing between the Niles Tool Works Co and ourselves, and until further notice all communications should be directed to the home office, Alliance, O."

AMERICAN STEEL AND WIRE WINS BATES SUIT.

The American Steel & Wire Co. was declared in the circuit court of Will County, Ill., Jan. 16, to be the owner of A. J. Bates' patent for the manufacture of woven wire fencing. Some time ago A. J. Bates resigned his position as an officer of the Bates Machine Co. and took a position as head of the patent department of the American Steel & Wire Co. The Bates Machine Co. filed a bill in chancery at Joliet, claiming that it had some interest in or at least a shop right under his patent and asked for a decree to that effect. The trial was friendly, although many important questions were involved in it. The American Steel & Wire Co. says it will continue to give the Bates company a large amount of work in the way of building field fence machines. The judge held that a certain contract made in 1888, by which A. J. Bates, the inventor of the machine, had agreed "to devote his energies and inventions to the Bates company" was not a practical one and in equity should not be enforced. There are at present 34 of these machines in existence—16 in Joliet and the remainder in Eastern mills. They turn out 100 miles of woven wire fence daily.

A. J. Bates, the inventor, is one of two brothers who early in the '80's started a small machine shop and found a backer in Joseph Winterbotham. In January, 1888, the Bates Machine Co. was organized. Mr. Winterbotham put in $10,000. A feature of the organization was a written contract between the three men, the substance of which was that Winterbotham put his capital against the Bates' inventive genius. The capital stock was placed at $20,000. The Bates each held a quarter of the stock and Winterbotham one-half. One clause of the agreement read as follows: "A. J. and W. O. Bates to devote their energies and inventions to the business, the same as they are now doing." That agreement was put away and but little thought given it for years.

The first suggestion of a woven-wire fence machine came, it is said, from C. E. Robinson, then with the Consolidated Steel & Wire Co. The Consolidated at that time manufactured barbed wire only. Mr. Robinson saw that this was not a perfect fence. He spoke to John Lambert about it, but did not receive much encouragement. Robinson finally took into his confidence A. J. Bates, who began work on plans in July, 1895, and in a short time had invented and patented a woven-wire fence machine. He and Mr. Robinson organized what was known as the Standard Railroad Farm & Fence Co., rented an old mill and prepared to realize on the invention. About this time the Consolidated company awoke to a realization of the fact that the new machine would render barbed wire useless, and after some negotiations the Standard company and all its patents were absorbed by the Consolidated, the price paid being $80,000.

The Bates Machine Co., in the meantime, had grown apprehensive that the valuable patent brought about by A. J. Bates was slipping away into other hands. There was a reorganization and A. J. Bates resigned as secretary and treasurer. He was retained on the pay roll, however, as consulting engineer, although he had entered the employ of the Consolidated. After several improvements a perfect machine was designed, capable of turning out 300 tons of finished fence a day. Then came the fight for the control of the machine and the decision noted above. It is probable that the case will go yet higher.

At Boston, Jan. 19, the United States Circuit Court of Appeals handed down a decision in the case of the State National Bank of Cleveland vs. Samuel Hayward et al., affirming the judgment of the circuit court, which was for the defendants. The plaintiff was a judgment creditor of the Findlay, O., Rolling Mills to the amount of $12,465, and in the action sought to enforce the liability of defendants as stockholders under an Ohio statute.

A wide circle of friends in the iron trade will learn with regret of the death of Mr. J. Blodget Britton, the senior member of the firm of J. Blodget Britton & Co. Mr. Britton died at his residence in Warrenton, Va., Jan. 19. The business of the Iron-Masters' Laboratory, with which he was so long identified, will be continued at Warrenton under the same name and under the management of Mr. Edwards F. Wilson, who has conducted the analytical work for the past six years.

ELECTRICITY IN ENGINEERING WORKS.

The development of electricity as a motive power for engineering works in the Manchester, Eng., district, is referred to by the London *Engineer*:

At the works of Joseph Adamson & Co., of Hyde, electricity as a motive power is being applied on an extensive scale, the various departments at the present time undergoing considerable alterations and enlargements, which when completed will be specially interesting. A few particulars of what has already been done by the firm in adopting electricity as a motive power are well worth noting. The power generating station which is close to the boiler house, contains hydraulic pumping engines, air compressors and the electric generators, and until quite recently the whole of the power required in the works was developed in this house. Owing, however, to the extensive alterations now being introduced and the putting down of additional machinery, the electric power plant has become too small and is shortly to be increased. In this connection it may be interesting to mention that while no appreciable saving in coal followed the installation of the electric power plant about four years ago, owing to the continued increase of machinery, the difference is very marked now that the firm have had to revert partially to the old-fashioned way of driving, and they are now quite sure that electric power in their shops, besides other advantages, means a saving in coal. Near the boiler house and power station they have just erected a large new boiler smithy, into which they are gradually removing from the old one, and they are making important improvements in the arrangements of the plant.

One noticeable improvement is in their special machine for flanging flues, which is being restarted with an electric motor directly coupled to it in the expectation that this will enable the work to be done more rapidly than when the machine was trap driven. This, at any rate, has so far been the experience of the firm whenever they have applied electric motors directly to strap driven machines, there being no slip or breakage of belts to interfere with the progress of the work. At the same time a hydraulic crane has been installed to lift the rings from the fire to the machine, while the fan supplying the fire will be driven by a separate motor, as it was before the removal. The boiler shop proper is well supplied with electric three-motor overhead cranes, as might be expected when it is remembered that the company were among the first to introduce three-motor cranes in this district, after having seen them work satisfactorily in the States in 1893. Several of the machines in the works are driven by individual motors, especially the larger ones, while the firm have also motors driving lengths of shafting where the machines are small and close together or where opportunity has not yet arisen to couple individual motors to some of them.

It may be added that at a number of other important engineering works throughout the Manchester district electrical driving power is being introduced on a more or less extensive scale, and at the large locomotive works of Beyer, Peacock & Co. considerable plant has recently been put down for adapting electrical driving to various portions of their shops.

The Cleveland Ball & Screw Co., whose office is 446 Arcade, Cleveland, and whose shops are in the old Brush plant in the same city, announces that it controls patents on machinery and methods for producing steel balls of all sizes—$\frac{1}{16}$ to 4 inches diameter, also patents on special automatic screw machinery. The company will be in position very shortly to fill orders for high-grade tool steel balls, properly hardened and tempered, accurate and uniform to size, carefully inspected and gauged. The company will manufacture, also, balls of such other material as may be specified—brass, bell metal, clay, composition, etc. The business is in charge of men experienced in the ball-making industry. Leo Mayer is president of the company and G. J. Bailey is secretary and treasurer.

The December movement of iron from Southern furnaces was beyond all records for that month, leaving the furnace yards nearly bare of stocks while ordinarily there is a considerable accumulation at the beginning of a new year.

The Amalgamated Association officers held a meeting at McKeesport, Pa., Jan. 21 to agitate the revival of union lodges in the mills there

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The Pittsburg Foundrymen's Association held its regular monthly meeting in the Frohsinn Building Monday evening, Jan. 23. The evening was devoted, with some digressions, to a very interesting discussion of Dr. Phillips's paper on the yard grading of pig iron, read at the December meeting. It was claimed that if the foundrymen required the furnacemen to sell their pig iron on analysis there would be no difficulty in arranging the matter; but it was well recognized that the foundrymen would first have to find out exactly what they wanted, and it became a question of the effect of the different elements on the behavior of iron. Many foundrymen bought iron on a silicon analysis, but there were other important elements and silicon was not all. It was pointed out that furnaces frequently had "off" casts, which they could not sell to the regular trade, but frequently were just the thing wanted for certain classes of foundry work; and it would evidently be a wise move for foundrymen to learn just what they could use in this direction, and then look for such lots, as they could be secured at a concession in price and the furnaceman would still be pleased. It was thought better for the furnacemen to prepare lists of the iron on hand, or which could be furnished, giving the analyses, rather than that the foundrymen should send out lists to brokers and others of what they might require, as valuable information might occasionally leak out that way.

When the discussion branched out into the effect of manganese on the cupola lining there was an interesting interchange of views in regard to Bessemer practice also. The chemist of a prominent Pittsburg steel works stated that seven or eight years ago he had formed a theory as to skulling in the converter, which was that if the manganese in the pig iron went below 0.4 there would be skulling, but if kept above that limit there would be no trouble from this source. He was not so much interested in the nature of skulling as in the practical means to prevent it; and for the past five years the experience at the steel works had been in full corroboration of his theory. There was objection to buying iron high in manganese, because it was all lost so far as the product was concerned, and it meant paying for something which did not appear in the steel, but considering the cost of removing the skulls and the loss of product during the time the vessel was idle, there was no question whatever about the economy of buying iron containing 0.5 to 0.6 manganese. Some blast furnaces had difficulty in furnishing such iron, as the manganese depended on the quantity present in the ore, but by securing the proper kind of ore, and mixing the proper proportion, the manganese could readily be regulated. It has been claimed that high manganese did not affect the lining of the cupola, but his experience was that beyond 0.8 or 0.9 in manganese the effect was to reduce the silica of the lining to silicon, which increased the silicon in the iron, and required constant patching of the lining.

It was objected to this theory that silica is not reducible to silicon at anything like the temperature found in such work, but on the other hand there is no proof that the presence of manganese may not have an influence, permitting the reduction to occur at a lower temperature. At any rate, the experience in the steel works in question had been that when the manganese got too high, the lining suffered greatly, and when it got too low, there was skulling.

In regard to the amount required for a cupola some interesting points were discussed. The tendency now is to drive fans faster and faster, in order to get more air and thus melt the iron faster. It was pionted out that greater tuyere area would solve the question better than driving the fans faster, or increasing the pressure of the blast. With a fan, unlike a positive blower, the actual gauge pressure is no indication of the quantity of wind going into the cupola. The pressure may be all right, but on account of contracted tuyere area very little wind may be passing. The increased speed uses up horse power very rapidly without much gain. Most of the men who run the cupolas think it is a great waste of wind to keep a slag hole open, and by having it stopped, the slag frequently gets up to the level of the tuyeres and stops some of them up, thus shutting off the wind supply. The loss of wind through a moderate sized slag hole is unimportant. Usually when more wind is required, it will be better to try increasing the size or number of the tuyeres before speeding up the fan.

It was the sense of the meeting that a great deal of good would come from a better understanding of the needs of the foundryman in regard to the chemical composition of the iron he uses, and hopes were expressed that some definite work could be accomplished by the time of the annual convention of the American Foundrymen's Association, which is to be held in Pittsburg in May, so that action could be taken based on the results.

Tin Plate Selling Arrangements.

Among other information coming to tin plate consumers, as the selling policy of the American Tin Plate Co. develops, is the statement that the well known jobbers known as the "Big Four," who handled nearly all the American tin plate business when the supply was imported from Wales, and who were later a very important factor in the distribution of the product of the American mills, have practically dropped all connection with the tin plate trade and will henceforth confine their attention to the other important lines in which they have been engaged. It is not known what arrangement was made with them. Frank Dickerson, of Dickerson, Van Dusen & Co., is Eastern sales agent for the American Tin Plate Co., his territory being all east of the Allegheny Mountains. W. H. Wells, formerly of Robt. Crooks & Co., will have charge of the Pacific coast business, his territory being all west of the Rockies. Between these limits sales will be made direct from Chicago. The company has opened an office in Pittsburg in the Lewis Block, Smithfield st. and Sixth ave., for the district manager for the Eastern mills, Berthold Goldsmith. It is understood there will be no sales office in Pittsburg.

The Philadelphia Iron Market.

Jan. 24.

There has been no large business in pig iron in the past week, but prices are higher. Buyers are provided for, in most cases for the next few months, and sellers are not looking for business; indeed, they seem rather to be avoiding it for the time being. No. 2X has been sold at $12 in 100- to 300-ton lots and $11.75 is probably as low as could be done. Makers are pursuing a conservative course and are not putting up prices in the way that once would have been quite the expected thing under such a strong consuming demand, and with stocks as low as they are to-day. We quote No. 1X foundry at $12 25 to $12.75; No. 2X, $11.75 to $12; No. 2 plain, $11.25 to $11.50; standard mill iron, $11. In billets new business would probably be done at $19.25, though some options have been closed at a trifle less. Steel for March or April delivery is scarce and makers are not making any effort for business. Finished material shows firmness in every line. Plates particularly are still hard to place in any quantity and a further advance is made, 1.50c being now generally asked for tank. Sheets are $1 to $2 a ton higher and unusually active for the time of year. Orders calling for considerable quantities of finished material, with long deliveries, are not entertained, and nearly as much business is declined as is being booked. Manufacturers appear to be taking care of their trade, and mills are not being tied up to large contracts that would put them out of reach of small-lot business. We quote refined bars at 1.15c to 1.20c; angles at 1.35c; beams and channels, 1.40c up to 15 inches. The situation in old material is constantly growing more favorable to the seller. Choice railroad scrap is quoted $13 to $13.50; No. 1 yard scrap, $11 to $11.50; machinery cast, $9.25 to $9.75; old iron rails, $13 25 to $13.50; old steel rails, $11.25 to $11.50, all delivered in buyer's yard, Philadelphia or within 100 miles.

THOMAS REYNOLDS, of London, Eng., representing the Egyptian government, was in Pittsburg this week to place an order for a few steel freight cars to be used on the Soudan railroad. Their use will be an experiment, and may be followed by an order for a large number.

SHEET manufacturers are sending notice to their trade that in accordance with circular instructions from the railroads, the minimum car load weight for black and galvanized sheets of all descriptions classified in fourth, fifth and sixth classes, will be 30,000 pounds, after Feb. 1.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

The Life of Ingot Molds. [*Stahl und Eisen*, Jan. 1.]—Mr. Oscar Simmersbach, of Zabrze, has a timely article on this question, and the views he gives will interest those of us engaged in making this class of work as well as the steel trade in general. A very strong and pure pig iron is required. The following are the limits in regard to the chemical composition of the pig iron used: Silicon, 1.50 to 3 50; manganese 0.60 to 1.20; carbon, 3.50 to 4.40; sulphur, not over 0.075; phosphorus, not over 0.120, and copper not over 0.125. The percentage of silicon and manganese depends upon the amount of scrap used in the charge. Moreover, if the fuel is rich in sulphur a high percentage of manganese is very desirable. A case in point is the practice in the Ruhr district of Germany. Here not over 0.8 manganese is specified, the coke being comparatively free from sulphur. The same specifications if transferred to the eastern portion of Germany would result in a shorter life of the ingot mold, for there is not enough manganese present to eliminate the excess of sulphur in the cokes of this region and carry it into the slag as a sulphide of manganese. The graphite should be in the shape of small, evenly distributed crystals. Overstepping the limits set for phosphorus and sulphur brings trouble, and while the blast furnace can readily furnish the desired iron, it requires constant watching. A point noted by Mr. Simmersbach, which, however, does not trouble us very much here, is the deleterious effect of arsenic present in some irons. Since it has been found that in ordinary blast furnace practice about one-third of the arsenic goes into the slag and none into the gases the balance evidently will be found in the iron, and consequently irons containing this impurity should not be used for ingot molds. Incidentally the iron ore from the south of Spain is quoted as containing arsenic sometimes as high as 1½ per cent. As arsenic acts similar to sulphur, the limit of the latter given as .075 should be understood to mean the combined sulphur and arsenic. Remelting ingot mold pig iron in the cupola requires closer attention and far greater experience and technical knowledge on the part of the founder than is the case for ordinary jobbing work. The normal composition of an ingot mold is given as follows: Silicon, 1.6 to 3.0 per cent; total carbons, 3.3 to 4.4; manganese, 0.5 to 1.1; sulphur, not over 0.075; phosphorus, not over 0.125, and copper not over 0.125 per cent. Our American practice would therefore seem very much more exacting in regard to the purity of the ingot mold.

Mr. Simmersbach next states that the silicon contents traceable to the pig iron bears little influence on the endurance of the ingot mold, molds with 1.6 per cent having been found as serviceable as those with 2.8 per cent. He claims that the silicon reduced from the lining of the cupola or from the ash makes the trouble, more graphite being separated, and irregularly at that. The fact is often noticed that the iron after pouring contains more silicon than the original charge. This state of affairs Mr. Simmersbach attributes to an overheating of the iron, and he therefore cautions the founder to watch his cupola temperature. A study of this statement would bring one to the conclusion that it is not the silicon which has become reduced which makes the trouble, but the overheating of the iron with the attending train of evils such as undue oxidation, structural weakness, etc. The sulphur contents of the ingot mold is the chief factor in its life. Foundries do not pay enough attention to this item in their coke. Here are a few of the German cokes: Dortmund coke averages 1.1 per cent sulphur, seldom going up to 1.4. In upper Silesia cokes are used running from 0.7 to 2.00 per cent sulphur. Waldenburger coke contains 1.8 per cent and Ostrauer 1.4 per cent. No wonder that coke analysis is recommended. The absorption of sulphur in the cupola means an increase in the combined carbon and a lowering of the total carbon in spite of the well known tendency of cast iron to absorb carbon from the fuel. Thus a pig iron containing .05 sulphur and 4 per cent total carbon when remelted with high sulphur coke resulted in an ingot mold with 0.27 sulphur and only 2.8 per cent total carbon. It is to be noted here that the lower the total carbon the more marked a given percentage of sulphur will appear in the casting. Ingot molds with .1 per cent sulphur are not of a very high order, with .15 and above red shortness becomes well marked, cracks form and the mold goes to pieces.

Next comes the effect of phosphorus. This is similar to that of sulphur, but not so marked. With otherwise good iron a contents of 0.125 gives no trouble; 0.18 and over, however, begins to make matters serious. An excess of phosphorus is often the result of impure scrap, or, what is often overlooked, the phosphorus contents of the coke. A case of this in upper Silesia is cited with .09 per cent phosphorus. Copper, which seldom bothers us in America, acts like phosphorus and tends to hold the sulphur in the iron. As to manganese, Mr. Simmersbach advocates its use, stating that with normal sulphur an ingot mold having 1 per cent manganese will last longer than one having only half as much. Manganese opposes the red shortening tendency of sulphur to some extent. With high silicon it is well to have high manganese, and vice versa. Thus one purchaser may specify 0.5 manganese and another 1 per cent. If the first receives a mold with 2 per cent and the last with 2½ per cent silicon, the effect on the carbons will be such that no difference can be detected readily between the fractures. The total carbon is best kept at about 3½ per cent. Only in cases where the walls of the ingot mold are very thin will 4.4 per cent be found admissable. The following are the analyses of five ingot molds, the first of which lasted through nearly 250 heats:

	I.	II.	III.	IV.	V.
Si.	2.65	1.66	2.80	2.82	2.16
Mn	1.00	0.55	0.83	0.83	0.73
P.	0.064	0.054	0.12	0.12	0.06
S.	0.061	0.043	0.04	0.04	0.05
Cu.		0.072	0.065	0.065	0.12
C.		3.45	4.40		

As the life of an ingot mold is in a measure the result of the influence of all of its ingredients a record of these, not now available, would be very valuable as a guide. Attention is further called to the importance of the foundry end of the question, the necessity of thorouhly drying the molds, casting at the proper time and in the proper way, and cooling very carefully. The endurance of the ingot mold is also dependent upon the treatment it receives in the steel works. The sudden heating and often irregular cooling produce changes in volume and molecular structure which make it especially important to handle the material carefully, a point neglected just as much as the nursing of rolls, and attended with similar results. The following is the average German practice in regard to the thickness of the rolls of an ingot mold:

Weight, lbs.		Thickness.	
770	2.4	down to 2	inches.
1,100–1,540	2.6	" 2.2	"
1,540–2,200	2 8	" 2.4	"
2,200–3,300	3.5	" 3.0	"
3,300–4 400	3.6	" 3.2	"
4,400–6,600	4.2	" 3.8	"
6,600–13,200	4.8	" 4.4	"
13,200–22 000	5.6	" 5.2	"
22,000–28,600	7.2	" 6.6	"

THE Benjamin Iron & Steel Co., of Buffalo, who purchased about 15,000 old cars from the Central Railway of New Jersey, expect to have all the material ready to market during April, May, June and July next. This is the largest single purchase of scrap iron ever made in this country and includes 25,000 tons of iron and 400,000 pounds of brass. All the cars are to be dismantled at Ashley, Pa., where the shops of the Central Ry. of New Jersey are located. The company is very busy at present, its export trade being particularly heavy in old iron and steel rails. Shipments of rails this month to date aggregate 10,000 tons, going to Italy, China and Japan.

THE Cambria Steel Co. announces that having leased the Cambria Iron Co.'s works, it has consolidated its New York offices (heretofore at 100 Broadway and 33 Wall street) at the new Empire Building, No. 71 Broadway, Rooms 1,705 and 1,706. H. L. Waterman, who has been made general sales agent for New York City and vicinity, will give special attention to the sale of structural steel, steel blooms, billets and slabs. W. A. Washburne will give attention to negotiations for steel rails and railway track fastenings, and L. R. Pomeroy to steel axles and other forging specialties.

DOMESTIC COKE AND BRIQUETTES FROM RETORT COKE OVENS.*

BY E. M. ATWATER.

Three years ago, by the kindness of your secretary, Mr. Haseltine, I offered to your attention the operation of the retort coke oven. In the interesting discussion that followed this paper, the possibility of using Ohio coals for blast furnace coke was considered, as being a desirable result for the large interests which you represent. I regret to say that but little progress has been made in the practical solution of this important question. Ohio coals are not used to-day to any extent in either retort or bee-hive coke ovens. Still the question is not finally settled. The two difficulties to be overcome are the high content of sulphur which injures the quality of the iron, and the high percentage of volatile matter in the coal which results in a soft bodied coke.

Fine Grinding of Coal a Partial Solution.

This same difficulty affects, to an even greater degree, the Illinois coal, and on account of the large requirements of coke in the Chicago blast furnaces efforts are constantly made to obtain blast furnace coke from these coals. A Chicago engineer claims to be able to eliminate the sulphur from the coke while at a red heat in the coke oven by blowing through it a jet of superheated steam and acetic acid. Even if this result should be accomplished, I doubt if it could be done economically. A well known Pennsylvania engineer has tried to accomplish it by grinding the coal fine and floating it through a pipe line from the mines to the great consuming centers of the middle west. He has demonstrated that coal with an equal weight of water can be transported for hundreds of miles, turning corners, ascending and descending grades, at a lower cost than by rail.

It was expected that one result of the fine grinding would be the reduction of the sulphur, but while there was some reduction it was not enough to make a coal having three or four per cent sulphur, suitable for making blast furnace coke, which should be not over one per cent.

But this fine grinding has advanced the solution of the problem and may yet solve it. It has been found that when coal is ground to pass through a 3-32 mesh, the pyritic sulphur and the float sulphur are both separable to a large extent. So, by means of a riffle, or a jig washer, the heavy pyrites are separated. Then by allowing the overflow of the riffles carrying the good coal and the float sulphur to pass into large settling tanks, the float sulphur is carried off in the overflow and coals carrying three to four per cent of sulphur are reduced to less than one per cent and so are brought into the blast furnace class of coking coals.

This process is, I believe, original with Mr. C. C. Upham, of New York, and while, so far as I know, it has not been put in practice on a commercial scale, yet it seems to me to have strong elements in its favor. This is a research which might engage the attention of the technical department of your State University. The resulting coal in the form of fine slack, reduced by draining so as to contain not over 10 per cent of moisture, is in the most favorable form for use in the retort coke oven. The operation of the oven still further reduces the amount of sulphur so that the sulphur present in a ton of retort coke is rarely greater than in a ton of the coal charged.

Regarding the second difficulty with Ohio coals, viz: the high percentage of volatile which makes a soft and spongy coke. A good many tests have been made at Syracuse on such coals, and it has been satisfactorily shown that these coals make a denser and stronger coke in the retort oven than in the bee-hive oven. Further, by mixing these coals with a small proportion of coals from other localities, such as Pocohontas or Pennsylvania, which naturally make a hard coke, this difficulty with the Ohio coals may be overcome. I believe therefore that the problem of making the Ohio coals useful for this the highest grade of coke is capable of solution, and with the large increase of iron making in Ohio, it may well engage your interest.

Recent Progress of Retort Ovens.

During the last four years, retort oven plants have been put in run in Dunbar, near Connellsville, Pa.; at Sharon, Pa.; Wheeling, W. Va., and Birmingham, Ala. All these plants make coke for blast furnaces, and the results from each are satisfactory, both technically and financially. The Dunbar Furnace, before the retort ovens were started, used exclusively bee-hive coke from Connellsville coal. This has given a good basis for comparison with the best bee-hive coke in the country. The Dunbar Furnace has surpassed all previous records while using exclusively retort coke, and owners and manager have given their opinion that the retort coke is better than standard Connellsville bee-hive coke. All these plants are likely to be enlarged to meet the increased requirements of the furnaces. The plant at Syracuse, N. Y., has already been doubled in size and for the last year has been supplying foundry coke of a high grade to all the principal iron foundries in the neighborhood of Syracuse.

A plant of retort ovens was built last year at Halifax, N. S., using Dominion coal. Since last June this plant has supplied the illuminating gas used by the city of Halifax. This plant has been able, by a special adaptation of the gas mains, to deliver an unenriched gas of 18 candle power directly into the holders of the Halifax Gas Co. This is perhaps the most important improvement to record in the devlopmeent of the American retort coke oven. There is also a large plant of retort ovens near McKeesport, Pa., running entirely on domestic coke, and a plant under construction at Boston, Mass., which will also make domestic coke.

Domestic coke is also being produced at many bee-hive oven plants and has been on the market for several years, competing with anthracite coal as a domestic fuel. The coke produced by illuminating gas plants has always been used to some extent for domestic fuel; but the form and character differ so materially from the crushed oven coke that it can hardly be said to have been a serious competitor. The rapid increase in water gas plants has also tended to decrease the supply of this form of domestic fuel.

Retort Coke from Ohio Coals for Domestic Use.

This leads to the main purpose of my paper, viz: The use of Ohio coals in their present condition for making domestic coke and briquettes in the retort oven, as a practical operation for the coal operators of Ohio.

For the ordinary use of the household, lump bituminous coal and anthracite are in general use, while slack coal is not used to any extent. Anthracite is used, I suppose, to a limited extent in the southern part of the State, but in the northern tier of cities is in general use, its freedom from smoke and gas making it more desirable and always preferred when the increased cost is not too great.

Crushed coke differs from lump bituminous coal in carrying no gas or smoke. In this respect it closely resembles anthracite, but on account of its porous character it burns more like bitumious than anthracite. Anthracite burns only on the surface, or until the lump, after becoming red hot, falls to ashes, or melts to clinker. Coke, when it becomes hot enough to burn, burns throughout its whole bulk and from the glowing mass falls quickly to ashes. On this account it occasions some trouble in managing the fire which goes out quickly when it is not supplied with fresh fuel at a time when anthracite coal would last much longer. Also, on account of its greater bulk, it occupies more room in the stove for a smaller actual amount of fuel.

Fuel briquettes have not been used to any extent in this country, but they have some advantages over any other domestic fuel. They are made in enormous quantities, estimated at 10,000,000 tons, in all the chief coal producing countries of Europe and have won a permanent place in the great markets of the world. Not only are they in common use as a domestic fuel, but the locomotives and steam ships of Europe use them very largely. They are made of different sizes, corresponding to the market sizes of anthracite coal, for boilers, locomotives, furnaces, grates and stoves. By their use the waste coal, both bituminous and anthracite at the mines and in the great coal depots in the cities, is completely utilized. If such a use can be made of the great slack heaps in the Ohio mines, it will be of far-reaching benefit to the miner and the household.

If briquettes are made of bituminous slack, they have the nature of bituminous lump coal, but on account of their density, being pressed as bricks at a great pressure, there is much less waste in dust, and slower and more economical

* Read at the meeting of the Ohio Institute of Mining Engineers, Columbus, O., Jan. 19, 1899.

combustion. But they can be made of anthracite slack as well as from bituminous slack, or from coke breeze, and in this form they have all the advantages of anthracite coal.

The retort coke oven affords the means of utilizing Ohio coal in either or all of these three forms, viz: Crushed coke, soft or smoky briquettes, and hard or smokeless briquettes; and it allows either or all of these forms of domestic fuel to be produced at a cost which will yield a good profit at the selling prices of their corresponding grades of fuel now in use.

Details of Operation.

To make this clear, I will give you the details of the operation of a block of retort ovens, on a practical scale and of a size best suited to economical operation. It will be quite practical to make an operation on a much smaller or a much larger scale, but an operation to produce 100 tons of coke and 100 tons of briquettes per day is a convenient unit to present for your approval and criticism.

The plant will consist of 18 retort coke ovens with all the apparatus for recovering the by-products—ammonia, tar and gas; also a tar distilling plant for converting the tar into oil and pitch for briquetting; and a briquetting plant for making 100 tons of briquettes in 10 hours. The plant will occupy less than two acres of ground and will cost, exclusive of land and a water supply and railroad connections, about $125,000. Such a plant can be operated in three ways, according to the amount and quality of the product desired.

First, let us consider its operation to produce, as I have said, 100 tons of coke and 100 tons of briquettes per day on Ohio coking coal: Each oven will take eight tons of coal and coke it in 24 hours, or 144 tons per day and 52,000 tons per year. The coal will yield 70 per cent of domestic coke, or 100 tons of coke per day, or 36,000 tons per year. The operation and maintenance in good repair of the plant will cost 40 cents per ton of coke, or $14,400 per year. There will be recovered from the volatile part of the coal in the by-product apparatus 520 tons per year of ammonia, reckoned as sulphate, which has an assured market value of $15,600, or amply sufficient to cover the entire cost of operating the ovens and by-product works. There will also be recovered from the oven gas 2,600 tons of tar, which has a market value of $4 per ton, or $10,400 per year.

After supplying all the heat required for coking the coal and raising steam for all the power required by the ovens and by-product works, there will be left a surplus of 3,000 cubic feet of gas per ton of coal, or 156,000,000 cubic feet of gas, which is worth for manufacturing purposes five cents per 1,000 cubic feet, or $7,800 per year. The low value given this gas does not represent its true value but its actual fuel value in replacing coal and reducing it still lower because it is produced at all hours of the day and all days in the year and no provision is made for storing it in a holder. The gas carries about 600 heat units per cubic foot and is for many purposes equal in efficiency with natural gas.

It is practically the same as unenriched illuminating gas. If local gas companies will, as has been done in Halifax in the past year, take the gas for their use, it can be enriched by the luminous portion of the fuel gas and can be delivered of 18 candle power. It would, of course, in this case be worth double the amount here estimated for it, and the holders of the illuminating gas company would be available for storing it. Still, at the figure above given, the value of $7,800 per year is sufficient to pay the interest on the investment of money for the whole plant.

The operation thus far stands as follows: The ammonia recovered will cover the cost of operating the ovens and by-product works, while the surplus gas will pay the interest on the investment. I do not state the cost of the coal, for that is a local matter. I also consider that any operation likely to be undertaken will be in the interest of coal operators. The value of the tar stands as a clear profit, and a ton of crushed coke costs only the coal required to make it. As it takes 1.4 tons of coal to make one ton of coke, if coal costs at the ovens $1 per ton, the cost of one ton of crushed coke is $1.40. If coal costs 50 cents per ton, a ton of coke costs 70 cents, and the $10,000 worth of tar is a profit or asset beyond this cost of the coke. As anthracite coal is worth $5.50 in the Columbus market to-day, the operation seems attractive.

The Making of Briquettes.

Taking up the second part of the operation—the making of briquettes—we will consider that the tar will have to be distilled. The cost of the distilling plant, about $5,000, I have included in the total of $125,000, for the whole plant, also the cost of the briquetting plant, $20,000. The distillation of the tar is a very simple operation, and the oils produced have sufficient value to pay for the cost of the distillation. We may therefore consider the 2,600 tons of tar as equal to 1,800 tons of pitch, which is the material used for cementing or binding the briquettes. If pitch alone is used for the bind, it takes eight per cent of the coal. If lime is used with the pitch, five per cent, 1,800 tons of pitch will therefore supply the bind for 36,000 tons of briquettes per year, or 100 tons per day.

The cost of operating the briquetting plant on the basis of 100 tons per day of 10 hours is given me by parties claiming to be familiar with the business as 25 to 50 cents per ton of finished product. As 100 tons of coal will make 108 tons of briquettes, we may say that 50 cents per ton of briquettes is a sufficient figure for the cost of manufacture, not counting the value of the pitch, which is a clear profit from the coking part of the operation.

We, therefore, have 100 tons of briquettes which cost what 100 tons of slack coal cost plus 50 cents per ton. If the coal costs $1 per ton, the briquettes cost $1.50 per ton, and will sell in competition with lump coal and be preferred on account of their uniformity of size and cleaner condition. Summing up the whole operation briefly, we have, after paying all operating expenses and interest on the investment, 100 tons of crushed coke, costing the value of 140 tons of slack coal, and 100 tons of soft coal briquettes, costing the value of 100 tons of slack coal plus 50 cents per ton. The value of the coal at any point where the plant may be located can be supplied and also the competing value of anthracite against the crushed coke, or of lump coal against the briquettes.

Alternative Plans of Treatment.

Two other methods of operation are, however, worth our consideration. As I said before, briquettes may be either made from soft coal, and consequently smoky, or from anthracite slack, or coke breeze or even Pocohantas slack, in which case they will be smokeless and in every way equal to anthracite. For this purpose the coke may be ground to a fine powder and the pitch used to make smokeless briquettes, which should command the full price of anthracite coal. On this basis the operation will stand as follows: 108 tons of smokeless briquettes will cost the value of 140 tons of bituminous slack coal plus 50 cents per ton. If this slack costs $1 per ton, the cost of these briquettes will be $1.80 per ton. If the coal costs 50 cents per ton, the briquettes will cost $1.15 per ton.

The other method of operation is of interest in view of the large quantities of non-coking coal in the Hocking Valley region. This slack coal is considered of no value at the mines, and its cost at any operating plant is simply its freight. This coal can be charged into the coke ovens and all the volatile distilled off and the tar, ammonia and gas recovered precisely as is the case with coking coal. The resulting carbon will be drawn from the oven, quenched and passed through rollers to make it of suitable fineness, and made into smokeless briquettes which will compete with anthracite coal. The cost will be the same as briquettes from the crushed coke, but the coal may be of lower cost and so the operation yield a greater profit.

These three forms of operation may be carried on in the same plant either simultaneously or at different times according to the conditions of the market for the several products. In general it may be said that coal is the cheapest form in which the various products, tar, ammonia, gas, coke and briquettes, can be transported, as the freight rates on coal are on the lowest basis of all commodities. Therefore in selecting a place for the operation the preference should be given to that place affording the best market for all the products. The consumption of anthracite coal at the place for the operation is also an important element, as it is easier to displace an article in common use than to create a market for a superior article.

The literature on the subject of briquettes may be found in the following: *Engineering and Mining Journal*, Oct. 12, 1895. *Cassier's Magazine*, Nov. 1896, and Dec. 1897. "Mineral Industries" Vol. 6, 1898.

A FURNACE-YARD CANTILEVER CRANE.

The method of handling ore followed at the furnace of the Punxsutawney Iron Co., at Punxsutawney, Pa., has features of interest, in view of the various departures made, as new furnaces have been built, from the less economical régime of hand labor. The system is an application of the Brown patent revolving derrick manufactured by th Brown Hoisting & Conveying Machine Co., of Cleveland. The crane is the largest type of a balanced cantilever crane yet designed, and is similar to one erected in the storage yards of the Brown works last year, though larger. The structure consists of two trusses, joined on their lower chords by substantial bracing and on the top by tie rods. The lower chords carry a runway on which a carriage travels, having suspended from it the hoisting mechanism. The span of the crane is 357 feet over all, and the trolley travel 350 feet. A walk or passageway is arranged directly above the track for convenience in keeping the hoisting mechanism in shape, and in looking after the equipment. The entire mechanism can be operated by one man stationed in the cabin directly above the house containing the power, as shown in Fig. 1.

The entire structure is placed on trucks, of which there are four, one at each corner of the base, which is 40 feet on each side. This base is raised on a circular sub-structure of stone, which is high enough to permit men to walk through the opening shown in Fig. 1, in going with ore or other material from the portion of the yard farthest from the furnace. The distance from the ground to the under side of the chords of the cantilever is 60 feet. On the base beneath the cantilever and resting immediately upon the trucks, which latter run on circular tracks, is the steam power plant. There are two engines, 10½ x 12 inches, which afford ample power. The load handled is 5 tons, the amount of ore carried in a bucket being 3½ tons.

The crane, with its three motions, commands all the yard space, as shown, and the bins into which ore is dropped from the cars. It is calculated that 125,000 tons of ore can be stored on the piles, this being from seven to nine months' supply, and thus considerably more than it would be necessary to accumulate at any one time. The ore as it is brought to the furnace is dropped into bins, which discharge on two sides. So much of the ore arriving in the season of navigation as can be used in current operations is put into bins opening on the side toward the furnace, being dischaged thence into buggies which are taken by men to the skip at the foot of the furnace incline. The bins opening on the stock yard side are used almost entirely for ore which is to be stocked with the machine.

In rehandling ore that has been stocked, the machine is used, and without the aid of hand labor buckets manipulated by the operator of the machine are dragged up the sides of the piles and filled; their contents are dropped into the bins on the furnace side and thence drawn out into buggies. Probably one-third of the ore used at the furnace at Punxsutawney is stocked under trestles which are quite near the furnace, and thus is not handled by the crane and does not pass through the bins.

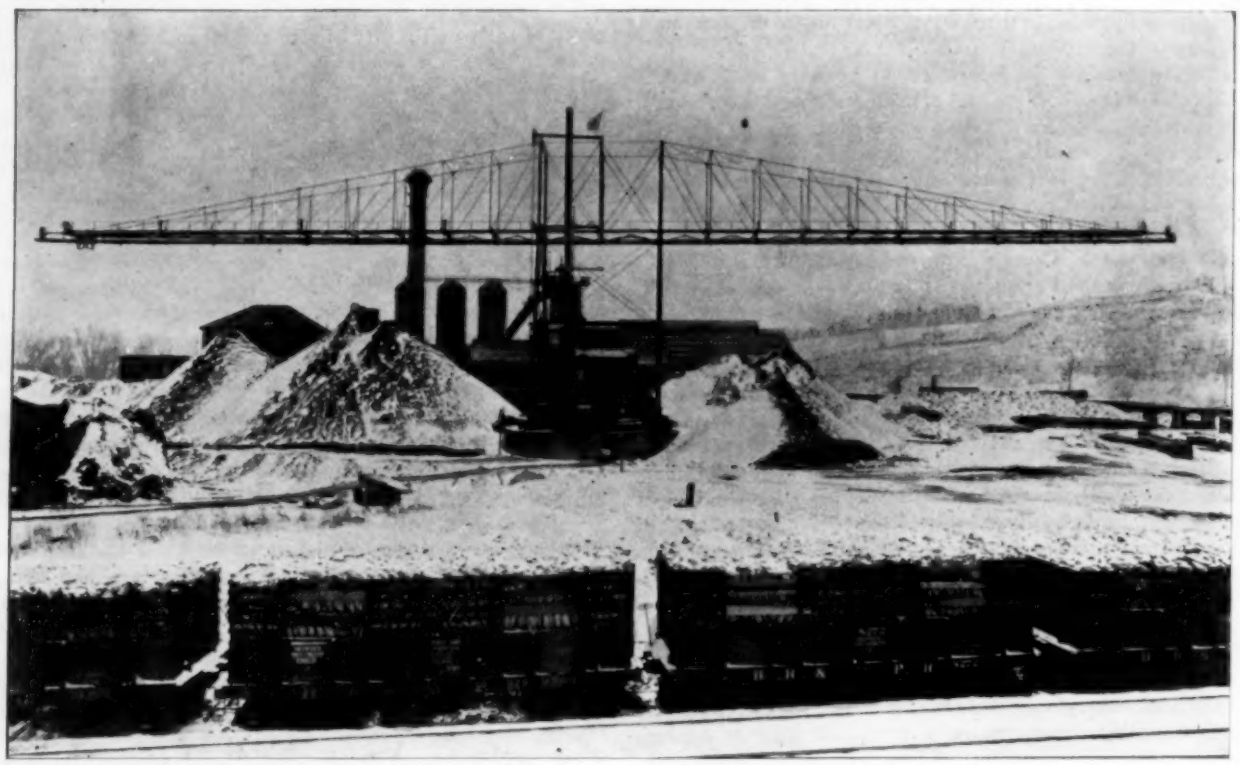


FIG. 1.—BROWN PATENT REVOLVING DERRICK FOR ORE-HANDLING AT PUNXSUTAWNEY, PA.

American Tin Plate Co. Personnel.

The vast machinery required to administer the affairs of the American Tin Plate Co. is being brought into working shape. The board of directors, being composed of 15 men, will meet only occasionally, most of its functions being performed by the executive committee, of which Mr. Leeds, the first vice-president, is chairman. The second vice president, W. T. Graham, is head of the sales department, in which Julius Goldsmith, formerly of the Pennsylvania Tin Plate Co., New Kensington, is chief clerk of the order department. The third vice-president, Warner Arms, will be in charge of the various managers. Berthold Goldsmith is manager in the Eastern district, which includes the mills at Demmler, Connellsville, Monessen, West Newton, Blairsville, Johnstown, Cumberland, Philadelphia, Brooklyn, and Baltimore. The mills at the three last named places will probably not be operated; indeed, one of the plants at Baltimore, the Locust Point plant, is already being dismantled. The workmen were offered free transportation to Europe or certain points in the United States by the tin plate company. John C. Oliver, formerly manager of the Monongahela tin plate plant at Pittsburg, is manager of the Pittsburg mills, the Monongahela and Star in the city of Pittsburg, the plant at Remington Station, and the two plants at New Kensington. William Banfield, formerly manager of Wallace, Banfield & Co.'s plant at Irondale, O., is manager of this plant and the plants at Cambridge and Lisbon.

Cecil A. Robinson will resign, it is stated, as president of the La Belle Iron Works, Wheeling, W. Va., to become general manager of the tin plate plants at Wheeling, Martin's Ferry, Bridgeport and Washington, Pa., now owned by the American Tin Plate Co. J. E. Wright, at present secretary of the La Belle Iron Works, is spoken of as his probable successor.

THE WALL STREET END OF THE IRON TRADE.

A feature of the new consolidation regime in the iron trade are the statements concerning the plans of the big companies which come out through Wall Street sources, for the information of the investing public. We give two recent publications below, relating to the Federal Steel Co. and the American Steel & Wire Co. They are both interesting, though in one or two particulars the touch of an unfamiliar hand is visible. For example, the reference to the control of "all the steel and wire plants" in the matter referring to the American Steel & Wire Co., and the Boston statement of the Federal Steel Co. director that street car rails are rolled at the Johnstown plant:

American Steel and Wire Co. Calculations.

The *Wall Street Journal* says: The interests which have been instrumental in forming the American Steel & Wire Co. believe that they have succeeded in obtaining control of practically all the steel and wire plants in the United States. There are two or three more mills which have not yet been purchased, but cash has been reserved to buy them. In the formation of the company it was intended that the new preferred stock should represent actual value on a very conservative basis of the plants purchased. These plants are mostly free of debt, except for an obligation of about $2,000,000 on the Washburn-Moen plant. The common stock represents those items which are usually spoken of as the "water" in a company's capitalization, that is, good will, etc.

The company has net current assets of about $15,000,000 in cash or its equivalent. By consolidation it expects to cut down its operating expenses from 83 per cent of gross earnings to about 78 per cent. It is intended to distribute work among the various factories in such a way as to reduce freights to a minimum. It is hoped that about $400,000 annually will be saved in this item alone. It will be the policy of the company to advance the prices of its products quite materially. The advance will be made by degrees, but will probably reach 20 per cent before long. It is intended to get pretty much all there is in the business, care being taken, however, to avoid stirring up competition and equipment of competing plants. The promoters of the company regard the preferred stock as an absolutely good investment. The common stock they regard as a speculation and they expect to market it generally around the present level, or a slightly higher level or price. It is quite probable that dividends will be paid on it at some future time. Some people in the company think that it will sell as high as 60. Others regard the present level as very fair, everything considered.

Status and Prospects of the Federal Steel Co.

A Boston special quotes a director of the Federal Steel Co. as follows:

"Rumors of our company consolidating or purchasing other properties can be set down as untrue. Statements in the press that our company was contemplating the purchase of other plants, etc., has led to all sorts of properties being offered to us, but we have no present intention of incurring any new liabilities. We intend to keep our present cash assets intact and add to same rather than otherwise. The Federal Steel Co. has a very promising future, for we have large orders on hand and more in prospect. It is too early to estimate what we will earn on the common stock. For 1898 we earned our preferred stock dividend and something on the common, but statements that the company will earn at the rate of 10 per cent on the common stock in 1899 are absurd, for there are too many things to enter into such calculations to give value to them thus early in the year.

"The value of the Lorain Co. is somewhat problematical as yet. It is valuable to us in view of its strategic position. It is devoted now to the manufacture of billets and miscellaneous products. The Johnstown plant is devoted to the manufacture of street car rails, while the Illinois Steel Co.'s plant at Chicago is run exclusively on steel rails. The only new construction in contemplation is the building of a cement plant at Chicago. We have been manufacturing cement from the refuse from our slab and other mills in a small way for some time, and we have met with such success in this line that it has been decided to expand. Such construction will cost less than half a million.

"The American Steel & Wire Co. is in perfect harmony with this company and is one of our largest customers. Rumors of trouble between the two companies have arisen no doubt through the resignation of Mr. John W. Gates, from the presidency of the Illinois Steel Co. and his activity in the American Co. It is true that Mr. Gates is not on very friendly terms with certain leading directors of the Federal Steel Co, but the relations between the two companies are harmonious. The American Co has taken some of our officers, including Mr. Gates and Vice-president Palmer of the Illinois Steel Co., but we have taken their treasurer, Mr. Buffington, and he has been elected president of the Illinois Steel Co and their auditor has been elected auditor of the Steel Co. I believe that there is no danger of the American Steel & Wire Co., entering into competition with the Federal Steel Co., for we could too readily return the compliment at a very small cost to us. The Joliet mill of the company is prepared to manufacture the products of the American Co. at a very small expense for alterations. A mill of the size of our Joliet plant would cut considerable of a figure in a price schedule. There are no indications, however, of any fight between the two companies; in fact, there is money for both companies in harmonious operation. Many of the leading directors of the Federal Steel Co. are among the largest owners of the company's stock, and they are holding the preferred stock as an investment, believing that it is a sure dividend payer, and they place its value above par."

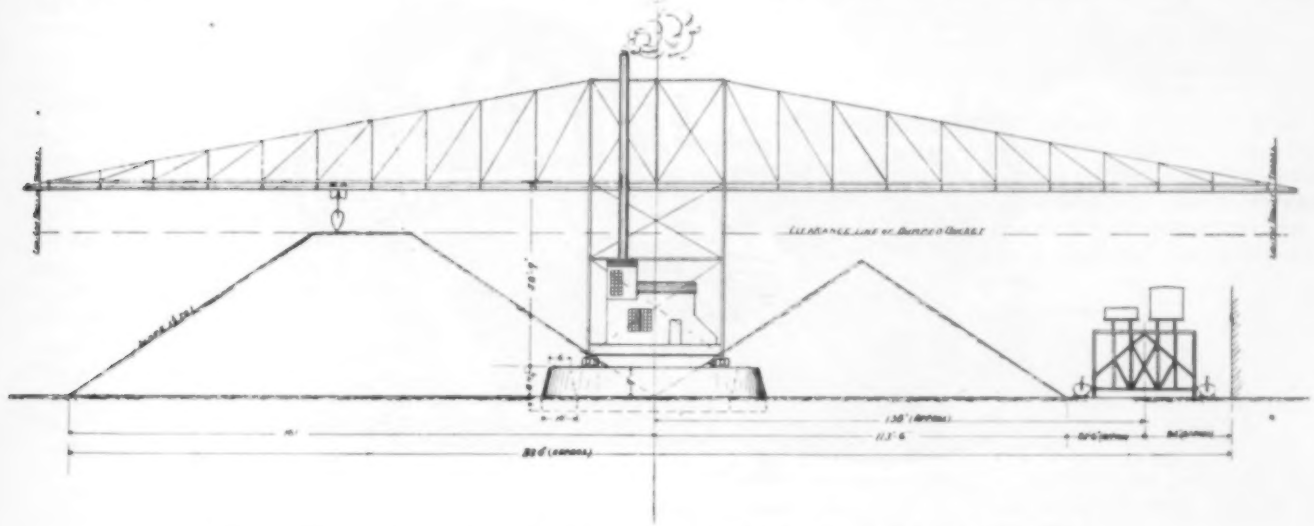


FIG. 2.—BROWN PATENT REVOLVING DERRICK FOR ORE-HANDLING. SECTIONAL ELEVATION.

SOME new records have been made recently at the Joliet plant of the Federal Steel Co. On Jan. 18 the converting department turned out 2,150 tons of steel, one 12 hour turn yielding 1,185 tons. The billet mill on Jan. 19 produced 948 tons of billets. The rod mill turned out on Jan. 17, 708 tons of No. 5 rods in 24 hours.

THE PRIESTMAN OIL ENGINE.

BY NORMAN M'CLINTOCK.

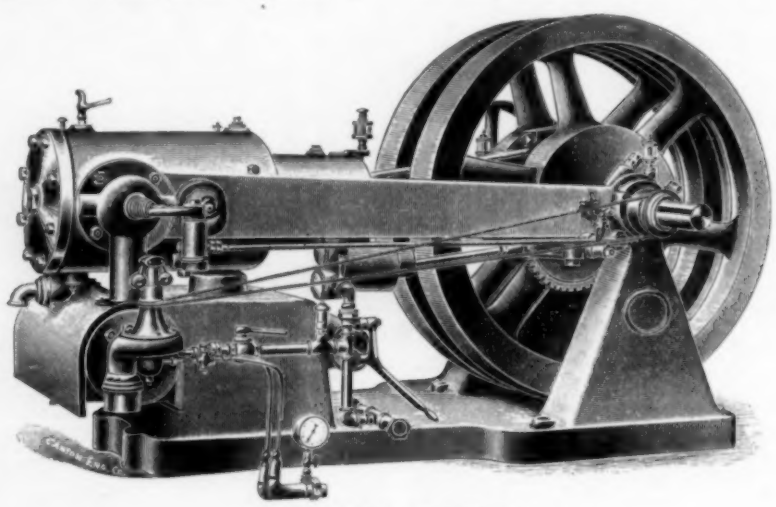
The constantly increasing popularity of internal combustion motors, which are being used for almost every conceivable purpose and which are found in the remotest parts of the world, should make a description of a comparatively new type of this class of motive power of interest. Since the successful introduction of gas and gasoline engines, experimenters have been working on internal combustion motors adapted for using as fuel the heavier and safer constituents of petroleum, such as the grades of kerosene or carbon oil commonly burned in house lamps. Such oils do not evaporate upon exposure to the atmosphere as do gasoline, naphtha, etc., and so not giving off explosive gases, are highly desirable in many places where the very dangerous nature of the lighter oils just mentioned, renders their use undesirable or prohibitive.

Until comparatively recently certain obstacles met with prevented the successful operation of engines using safe oils. Through the ingenuity of scientific men, however, these obstacles have now been overcome and the success of the safety oil engine is an accomplished fact.

The Aultman Co., of Canton, O., has recently taken up the manufacture of the Priestman safety oil engine, which, aside from the character of fuel used, differs from gas and gasoline engines in several important respects. A glance at the engine cut will at once show the general form of construction. Of this, the most striking feature is, perhaps, the position of the fly wheels, which are mounted between, instead of outside the main bearings, as is the general practice. This method of construction is known as the "straight-line" principle, and has been highly commended by prominent engineers. As the power transmitted by the connecting rod is absorbed by the fly wheels without first being transmitted through the main bearings, the latter are relieved of a tremendous twisting strain. This fact is evidenced by the minimum of wear and of lubrication required. The design of the engine is exceedingly simple and the working parts are very few. The only parts about the engine that are mechanically operated are the exhaust valve, the governor, a small power pump which is operated by an eccentric for pumping the oil, and a little device for making and breaking the electric battery circuit. For fuel is employed only high test, safe petroleum, such as is used in common house lamps, and generally known as kerosene or carbon oil.

The following is the method of operation: A fine kerosene spray is injected into the chamber shown directly underneath the cylinder head. Here this spray is mixed with the proper proportion of air for supporting combustion, and the mixture heated by the hot exhaust gases, which are made to pass through an annular space surrounding this mixing chamber before being expelled into the atmosphere. The heated charge of oil spray and air is then drawn through the inlet valve into the cylinder, by an outward stroke of the piston. The inlet valve is not mechanically operated but is opened automatically by suction, or in other words the pressure of the atmosphere. The return stroke of the piston compresses the charge which is then ignited by an electric spark from an ordinary battery, and the resulting expansion of the heated products of combustion drives forward the piston, thus imparting the energy which is utilized for doing work. During the succeeding stroke of the piston, the exhaustvalve is held open mechanically, and the dead gases are swept out of the cylinder, which is thus prepared for the reception of a fresh charge of oil and air. The cycle of events just described embraces two revolutions of the fly wheels.

The chief departure from the gas engine principle of operation is in the treatment of the fuel, a considerable portion of which, if not all, is burned as a liquid spray instead of as a gas. This fact is evidenced in two ways: First. The proportion of air and of a gas must be very exact to give an explosive mixture—about 10 volumes of air to one of gas. If this proportion is not closely adhered to in gas and gasoline engines, no explosions, or very weak ones will result. This generally accounts for the difficulty sometimes experienced in starting gas and gasoline engines. The proportion of air necessary for burning a given quantity of liquid oil is many thousand times the latter and need not be so exact to obtain an explosion. The Priestman engine is very easy to start and no trouble is experienced from this source, as almost any mixture of air and oil will ignite. Second. A very small portion of the oil spray within the cylinder coats the walls of the latter and so perfectly lubricates them that no other means is ever provided for this purpose. This is a most distinctive and important feature, for no special cylinder oil is ever used, and no attention to this point is ever necessary.



THE PRIESTMAN OIL ENGINE.

By reason of the positiveness of the cylinder lubrication, the cooling water surrounding the cylinder can be allowed to boil without increasing the friction, and with beneficial results. It is only necessary to have sufficient water for keeping the cylinder jacket full. This feature is very advantageous with portable engines, and in localities where small water tanks are advisable.

The oil, which is kept in a tank—located wherever convenient—is pumped into the spray maker under a pressure of about eight pounds. The oil consumption is about one and a quarter pints per brake horse power per hour. Looking at the question of consumption in another way, every time an engine receives an impulse, it requires the burning of only about one and a half drops of oil to produce each horse power. This fact is a good illustration of the astonishing amount of energy that is stored in a minute quantity of oil.

The steam engine method of governing, that is, by throttling the charge, is employed and impulses are taken regularly whether the engine be running empty or fully loaded, each charge of oil spray being exactly proportioned to the load carried. The excellent speed regulation of the engine especially adapts it for electric lighting and a steady incandescent light can be obtained without the use of counter shafting or extra balance wheels. It is an interesting fact, and one possibly not generally known, that by using a given quantity of oil in the Priestman engine for operating incandescent electric lights, more illumination can be secured than if the same quantity of oil were burned in a common house lamp.

It may be of interest to the reader to know, also, the

actual amount of work that can be secured from a small quantity of kerosene burned in a Priestman engine that is operating some of the most common classes of machinery. Take electric lighting, for instance. One pint of kerosene will run eight 16 candle power incandescent lights, or one 1,600 candle power arc light for one hour. When operating an ice machine, a pint of oil will produce about 200 pounds of ice at 15 degrees F. from water 70 degrees F. If attached to a hoist, 100 tons can be lifted four feet, or one ton 400 feet by one pint of oil; and when used for pumping, the expenditure of this small quantity of oil will raise 1,000 gallons of water 96 feet high. In computing these figures, due allowances have been made for the average inefficiencies of all apparatus employed.

As the Priestman engine is very simple in its method of operation, and is entirely automatic in its action, it is admirably suited for places where there is desired a cheap, safe, and reliable motive power, which can be satisfactorily handled by unskilled labor, and which demands the least attention. The Aultman Co. has recently added a number of improvements to the engine, amongst them being an air storage system whereby engines can be easily started without recourse to any preliminary hand pumping or turning of the fly wheels.

Record of the Cramp Ship Yard.

In a little resume of its shipbuilding operations, the Wm. Cramp & Sons Co., of Philadelphia, point out that their plant, which covers 31 acres, represents an investment of more than $5,000,000 and gives employment to over 5,000 men, who draw in wages weekly about $50,000. During the 68 years since its establishment the company has built 301 vessels of all descriptions and 185 marine engines. Of the vessels, 23 have been United States steam men-of-war, six steam cruisers for the Russian navy, and one gunboat for the navy of Venezuela. Over 100 steamers and steamboats have been constructed, including the Southwark and Kensington and the magnificent American liners St. Paul and St. Louis. There have been a dozen yachts and over three-score of tugs, including the Sampson, which was the first steam tug built in America. Twenty-eight sailing vessels were built, 11 vessels rebuilt or lengthened, and 60 other craft constructed. In modern vessels of its new navy, the United States has expended at the Cramp shipyard in recent years $25,250,000. The work in hand upon the Alabama, the Maine, the Russian warships and the completed Kasagi will bring the total up to $38,000,000, aside from the private contracts.—[Marine Review.

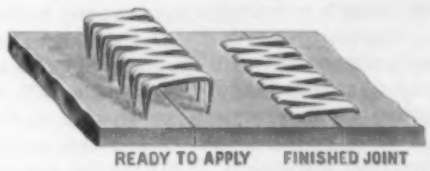
THE rebuilt tin plate plant formerly owned by the U. S. Iron & Tin Plate Co., Demmler, Pa., has been in steady operation since the first of the year, with 10 mills running on tin plates and sheet iron. The eleventh mill is ready for operation, and was expected to be started this week or next. The new plant is thoroughly modern and is capable of rolling tin plate or sheet iron, the old company having built up a fine reputation for specialties in each. The works are laid out so that a number of additional mills may be put in position, and some transfers from other plants may be made to this location.

THE incorporation was noted in these columns recently, of the Chartiers Iron & Steel Co., Pittsburg. The new company is taking over the entire business of the Chartiers Iron & Steel Co., Ltd., which was a limited partnership, having a capital stock of $60,000, although the value of the plant, etc., was greatly in excess of this. The corporation has a capital stock of $100,000. James Lippincott, who has been closely identified with the management the business, especially since the death of Mr. Kirkpatrick, is now a stockholder. John Henry, who was chairman of the limited partnership, is now president of the company, which has a sheet mill at Carnegie, in Allegheny county, containing three hot and two cold mills and a steam hammer.

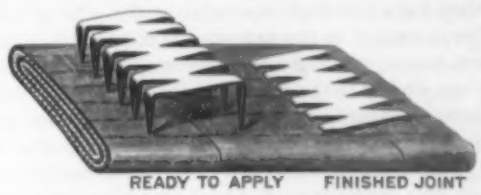
There appears to be no foundation for the report that the plant of the Wisconsin Steel Co., at West Superior, Wis., will start again. The machinery is in bad condition, having long been idle. About 65 men are now employed in the pipe department, but nothing further is contemplated.

BRISTOL'S PATENT STEEL BELT LACING.

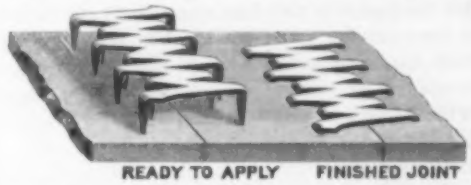
It is now nearly 10 years since the Bristol Co., of Waterbury, Conn., began to manufacture patent steel belt lacing which has become in that time familiarly known and very generally used at home and abroad. There are over 100 different sizes and lengths adapted to different styles and widths of belting. The illustrations, Figs. 1, 2 and 3, show the three different types that are made, of which Fig. 1 represents that originally placed upon the market and designed particularly for leather belts. The type illustrated in Fig. 2 was brought out later to meet the demand for a fastener for woven belts such as are made of cotton and rubber. In this style the distance between the rows of spurs



is greater than in the original form shown in Fig. 1, and thus affords a better hold on ends of a belt of a woven or fibrous nature. Both types of the lacing shown in Figs 1 and 2 have the patented feature that they are formed from blanks of a zigzag shape, this shape permitting of cutting the blanks successfully from a ribbon of steel without waste of material.



The latest design shown in Fig. 3, which is now being introduced, combines the special features of both of the previously described types, the essential difference being that there are two rows of spurs on each side of the center, instead of one. The patented features of this latest design are that the blanks used are of a zigzag form and that they may be successfully cut from a ribbon of steel without waste of material, each blank as it is cut off simultaneously forming one side of the blank for the next lacing.



The advantages of this new form of lacing are that it is equally applicable to leather, cotton or rubber belts, and that the double rows of spurs on each side of the joint insure greater strength, especially when applied to old and partially worn belts. All the above types have been carefully designed to give maximum strength with minimum amount of material. All three styles are easily applied without use of special tools, making smooth and elastic joints. Samples will be mailed free on application to the makers.

NEARLY 40 years ago Mr. D. K. Clark testified to "The advantage of a rapid, or rather intense draft, in perfecting combustion and extinguishing smoke," upon which Mr. C. Wye Williams was led to remark: "But the difficulty lies in the obtaining of this 'intense draft.' The absolute command of draft for the generation of the required quantity of steam, to enable the engines to work their full power, being then so essential, it becomes a question whether other means than the natural draft should not be resorted to; since, independently of the uncertainty in the amount of draft, and the consequent irregularity in the working effect of the engines, the cost of sustaining that draft may be so much in excess of what an artificial draft would be." M. Peclet also at this time investigated the subject, showed the low efficiency as compared with a fan, and recommended the use of rotary fans, applied for exhausting on the induced system.—[From "Treatise in Mechanical Draft," published by the B. F. Sturtevant Co., Boston, Mass.

EUROPEAN-AMERICAN SHOP MANAGEMENT.*

European manufacturers do not, as a rule, appreciate the fact that high-class and accurate machine tools are necessary auxiliaries to economic production, and that in selecting them quality should be the first consideration. Want of understanding in this respect, on the part of both employers and employes is one of the most serious drawbacks to progress among European manufacturers. The accurate machine tool is the stronghold of the American manufacturer. * * *

To an American manufacturer visiting European machine shops, the most striking thing is the immense variety of work turned out by establishments of any size whatever. He is invariably astonished at the variety of work undertaken, even by small shops—a variety rarely attempted by any American establishment. There are many machine shops, both in England and on the Continent, that will supply complete plants of machinery, and manufacture within their own walls boilers, engines, shafting, hangers, pulleys, small tools, and all sorts of machines, both large and small. While this state of affairs may be explained historically, it cannot be defended as an economic principle, in the light of modern practice. The very opposite policy is followed by most American makers of machinery. Many concerns could be mentioned which devote themselves entirely to one line of machinery, and have no hesitation whatever in refusing business or orders for anything which they are not specially equipped for producing, and of which they have not made a special study. In a number of cases this is carried to the extreme. One firm makes nothing but turret lathes, and only one size at that. Others confine themselves wholly to the manufacture of drilling machines, or of lathes, planers, milling machines, grinding machines, etc. In fact, in America every article in the list of machine tools is receiving particular attention from specialists The effects of this specialization are interesting and entirely in accordance with modern progress, and this one fact contributes largely to the success of the American manufacturer of machine tools in producing an article of the best workmanship and most approved design at the lowest price. As in chemistry, medicine, surgery, or any of the arts and sciences, the field in machine construction is to-day so wide that it is impossible for any one mind to grasp all the details of its different departments, or to master the immense number of facts which are being collected, and the theories which are being developed by specialists. A natural segregation has occurred in all the arts and sciences, and the American idea of specializing in the manufacture of machine tools is but a practical application of this principle, which is being adopted in every calling. European nations must follow the same lines, if they hope to compete. We have specialists in art, medicine, law, in all professions and in many industries, why not in the manufacture of machine tools? There are, and will continue to be, conditions which call for all-round mechanical engineers, but certainly the field for such is decreasing.

It will be well to call attention to some of the good effects which specialization has on general manufacture, and to the resulting advantages which the American maker of machine tools is securing in competition with Europeans. In the first place, special engineers are being produced,—men who are confining themselves to the study of one class of machinery, and are constantly working at the design of a particular line of tools. They study to increase the capacity of these machines, to broaden the field of their application, and to make them cheaper. These special engineers are becoming a necessity to manufacturers, and they occupy to-day, in America, a recognized position as authorities in their special lines. Their standing and reputation are of commercial value to the companies with which they are connected, and are the equivalent of a good will, which is a valuable asset. The effect of their work is to develop and produce a machine best adapted to the end in view, and to make it at a price with which the manufacturer of many and varied classes cannot possibly compete. This method of working has also produced a class of expert workmen and tool makers who, by confining themselves wholly to one branch, have had the opportunity of designing special tools for the production of their class of machinery, and have become, by experience, so adept at their work as to be able to turn out machines with a high degree of accuracy, and a good finish, at a low price. Each specialist is constantly exerting himself to make his machine produce the best work, and to make improvements by which he can reduce the costs of manufacturing to his customers. He is ever on the alert to make any new application of his machine, to enable him to compete with makers of other lines.

There are many interesting examples of this specializing competition, one of which is that of the planing machine and the milling machine. A short time ago the wonderful results produced by the milling machine were proclaimed by many as the precursor of the downfall of the planing machine. To-day it seems to be fairly settled that these two machines should work in the most friendly way, and that alternate planing and milling on the same piece is, in many cases, the most advantageous way of producing good work. The planing machine is now made in America by several companies that make no other machinery; the same can be said of the milling machine. The result is that both are made better and more cheaply than ever, and the product of each is largely increased. The same contest has taken place between the turret machine and the lathe. We find work being done on the turret machine which was formerly done on the lathe, and, at the same time, better results are attained on both machines; that is to say, the lathe and the turret machine are producing the cheapest and best work by an interchange of operations.

Similar improvements are the result of the study of the grinding machine by specialists. Parts are roughed out on the lathe nearly to size, and then finished truly cylindrical, and to gauge, on the grinding machine. With this method no special skill is necessary for either operation; that is to say, no specially skilled "turner" is necessary and exact results are attained on the grinding machine by workmen who have served no long apprenticeship.

One of the most striking results of specialization has been in the recent development of the automatic screw machine. This machine, which was originally used for the production of small parts, mostly machine screws, is now made to turn out many complicated and expensive forms. Bicycle hubs, ball handles, and complicated parts, drilled out, turned all over, and threaded, are now produced on the automatic screw machine from a bar of material, one workman attending from six to ten machines. Only a few years ago this was unthought of, or deemed impossible. The development of this class of work may be attributed wholly to specialization of talent, plant, and management.

Not only are the Americans sending abroad quantities of machines adapted to special purposes,—largely bicycle parts,—but there has also been a very large exportation from the United States of regular machine tools, such as lathes, milling machines, planers, drilling machines, etc. In the regular lines of machinery, like the above, where advantages common to special machinery are not an inducement to buy, the machine being a regularly-catalogued article, the American makers are competing with the European manufacturer. This success is also due almost entirely to specialization. Factories could be named where these results are attained through no particular superiority in design of the machine, but simply through the fact that the whole engineering and commercial staff is devoted to the production of one article. Such machines as lathes and drilling machines are turned out in lots of one hundred, and even larger quantities. Parts, such as head-stocks, tail-stocks or slide-rests, are "jigged" like sewing machine parts, holes being bored, drilled, and counterbored without the use of a boring mill. Smaller parts, such as hand wheels, change gears, or cone pulleys, are made in still larger quantities, and are carried in stock. All these smaller parts are made interchangeable and to gauge, and are held in readiness to be put into machines as fast as they are to be assembled. In this way machine tools are "manufactured," and the operations are largely performed by comparatively unskilled labor. How is it possible for those who make one machine to order, or make small lots, as manufacturers of a great variety of machines must do, to compete with these methods?

It should be mentioned that some results not altogether desirable are noticeable in American practice where special efforts have been made to reduce machine-tool production to a manufacturing basis. Some of the American makers have

* From an article by H. F. L. Orcutt, in January *Engineering Magazine*

gone so far in their efforts to produce quantity that they have sacrificed quality. Machine tools can be "manufactured" up to a certain limit; beyond that they must be "made." The great bulk of machine tools can be turned out in quantities at a low cost, but the fine, accurate machinery, which is really the foundation of all good and cheap production, calls for the highest skill of the experienced workman, as well as for the finest judgment in design. The ideal machine shop is one in which the most rational methods of manufacturing are combined with the most accurate finish and thorough inspection.

In America the practice is also thoroughly established of separating the heavy from the light machine-tool manufacture. This is done by European makers, although not so extensively or effectively. No makers of note in America are producing both light and heavy machinery. On the other hand, in European countries it is the rule rather than the exception for machine-tool makers to produce both heavy and light machinery. This is difficult. The engineering problems are so different, there is such a variation in the demands of customers, and the plants and workshops best adapted for the manufacture of heavy or light machinery are so dissimilar, that the two branches cannot be worked together satisfactorily.

Some of the success of the American machine tools in the European market is undoubtedly attributable to the fact that the specialized manufacturer is largely used as a consulting engineer. European manufacturers are making extensive use of the American specialist as a source of information by which their articles can be more accurately and cheaply produced. All this consulting work is free to the customer, the machine-tool maker getting his "fees" through profits on tools supplied. In addition to the technical advantages which can be offered on account of specialization, the salesman also finds it to his benefit to make a particular study of the wants of customers, and in this way to extend the interest of all concerned.

With respect to the European situation, it must be admitted that specialization of manufacture in the machine-tool business is but slightly developed. Not one case of a company in Europe devoting itself wholly to one line of machine tools is known to the writer. Such companies may exist, but they certainly have neither the reputation or the standing that we find among American manufacturers of machinery. The hap-hazard practice of European machine-tool makers has a noticeably bad effect in many ways. One of the most serious is that it operates to produce indifferent workmen and designers,—men without any special training, experience, or interest in any particular line. Men who are making a steam engine or a boiler one day, working on a lathe next week, and operating a planing machine the week after, cannot be expected to have any particular interest in a special line, or any skill in making or developing that line. The results are, of course, slow progress in design, little application of improved methods, and indifferently-made machinery. The evil effects are seen throughout European workshops, in their equipment and organization. Even the simplest articles cannot be properly manufactured on crudely-developed machinery. There are various conditions affecting European makers which do not, of course, influence American manufacturers. The conditions of trade are not alike, particularly as carried out by exporting houses in London, Antwerp, or Hamburg. Undoubtedly the peculiar state of the European machine-tool makers has been partly brought about by their large export trade, and the fact that they undertake to produce every article called for by foreign inquiries or indents, where complete plants are required. But no conditions can justify the present attitude of the European maker of machine tools. He must apply himself to one line, and perfect and develop that line, avoiding both general manufacturing and general trading.

G. H. Tenbroeck has dismissed his suit at St. Louis against John W. Gates and E. H. Gary, for $1,875,000 on the wire mill deal. The suit grew out of the original negotiations for the formation of a wire consolidation, the plaintiff claiming that $3,700,000 was cleared by defendants. A compromise was made.

CONTINUOUS POURING.

Why is the system of continuous pouring not more generally adopted in foundries having a special class of work in which it may be done to advantage? Some time ago I had the pleasure of going through a number of foundries, and was very much supprised at the large amount of small work to be poured off. It occurred to me that the continuous melting would be an advantage in some cases. It seems to me that it would be more advantageous to bring the molds to the cupola, than the system of taking the iron to the molds, not taking into consideration the large amount of floor space that may be put to other use, in not having the molds all over the floor. By this system of pouring off, the molders would be able to start in producing molds first thing in the morning instead of tempering over a large sand pile, and continue to do so all day. There is no need to have skilled help put in one-third of the time doing a class of work that can be done by laboring help quite as well. The pouring can be done by other help than the molder in better shape after a little practice. There are lots of molders practically incapable of pouring any kind of a casting with good results; it is more by good luck than judgment that they get a casting at all.

Some years ago I had charge of a small foundry, running 15 molders, mostly on very light work, for which we had a large number of orders, and were not able to fill them as fast as desired under the old system, and not having room for more molders I decided to try the system of continuous pouring, and was very much gratified with the result. It had been the practice of the molders to temper their sand and pour off, which means that we only got about 7½ hours' molding per man each day. After having made arrangements to do all of this work so that the molder did nothing but mold, we got a full 9½ hours for each man, being a clear gain of 30 hours per day molding, or in other words, equal to four extra men under the old system; the increased output of the molders more than covered the expense of the laboring help, and not having the castings to clear from the floor and take care of (as the molds were taken out to a shed put up on purpose where the sand was tempered, and castings put where wanted at the same time), the cost was diminished.—[E. J. Baker, in *Foundry*.

Tests of Nickel Steel.

London *Engineering* refers to a series of exhaustive tests with nickel steel made at the Charlottenberg Testing Institution, near Berlin. The chemical composition of the specimens used varied between 99.6 and 0.33 per cent of iron, with 0.05 to 98.4 per cent of nickel, the percentage of other ingredients, such as cobalt, copper, manganese, aluminum and sulphur, being very small. The percentage of cobalt varied from 0.01 to 1.03 per cent, it increasing with the percentage of nickel. The following table shows how the physical characteristics are affected by varying the proportions of nickel:

Per cent. of nickel	Limit of elasticity. Lbs per sq. in.	Tensile strength. Lbs. per sq. in.	Elongation Per cent.
0	20,030	45,472	30
8	62 496	79,520	10
16	.....	58,240	1
30	.....	14,224	2
60 to 98.5	.....	53,760 to 42,560	36 to 17

When the nickel was increased from naught to eight per cent the elasticity limit and tensile strength increased steadily, the greatest strength being found with eight per cent nickel. With more nickel the conditions became irregular, as indicated by the above figures. As regards the fractured surface of the various alloys, with 0.5 per cent nickel it was porous but became close with one per cent nickel. With three per cent nickel the fractured surface was fine in grain, but with an increasing percentage of nickel it became more and more coarse, eventually showing needle-shaped crystals. As an exception, with 60 per cent nickel, when the strength conditions again became normal, there was a fine grain. The results obtained on compression were quite similar to those given by the tensile tests. Nickel steel was found to stand rolling only when the percentage of nickel was no more than four per cent, the metal showing fractures when the percentage of nickel was larger.

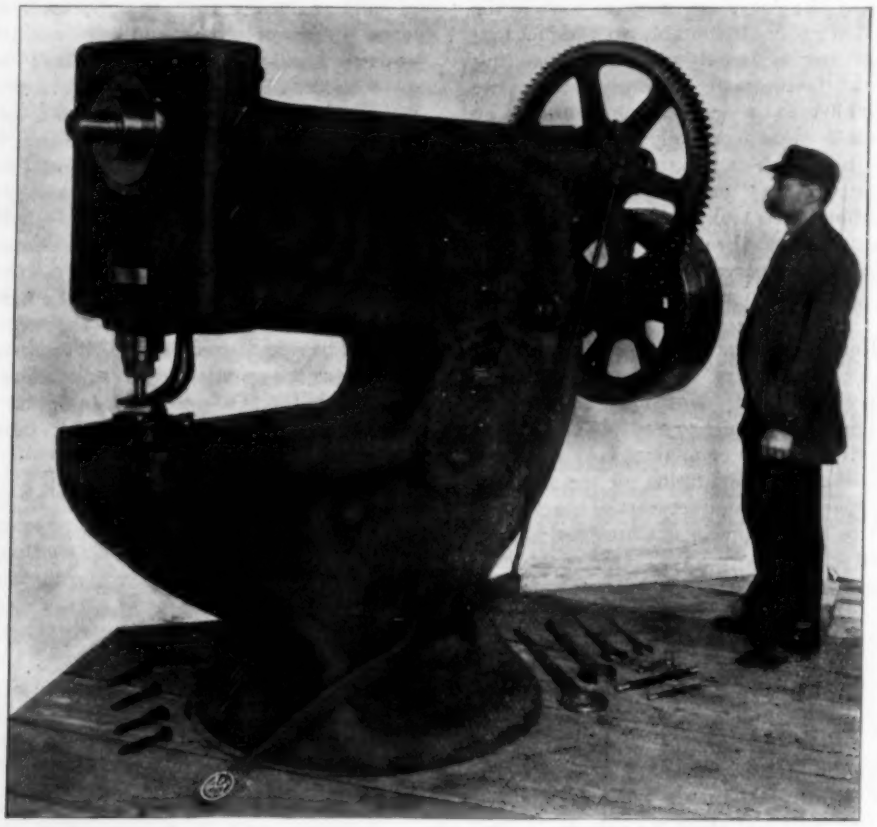
The Crane Iron Co., Catasauqua, Pa., will blow in another stack Feb. 1, making three in blast.

DEEP-THROAT PUNCHING PRESS.

A press recently added to the extensive line of the Ferracute Machine Co., Bridgeton, N. J., is shown in the accompanying half-tone cut. The weight is 5,300 pounds and the depth of throat, from the center of the ram back to the frame, 30 inches. The height of the ram when up is 9½ inches above the bed; the stroke of the ram 1¼ inch. The fly-wheel is 25 inches diameter and its speed 360 revolutions, while the speed of the main shaft is 60. This press is adapted to shearing and punching tank or light boiler work or to any other service in which a deep throat is required. There is an automatic clutch, with simple adjustment, and most of the improvements found in the company's regular lines of punching presses. Two sizes are built, with and without gearing.

THERE has been a scarcity of houses in Homestead, Pa., for some time, but during the last two weeks the demand has grown so rapidly that 600 or 800 houses could be rented. The increased demand for houses is caused by the number of men being brought into the town by the Carnegie Steel Co., Ltd., to work on the improvements being made to its plant. Nearly 600 laborers were put to work last week excavating for the new mills, and as many more this week, when work was started on the three new mills purchased from the Bethlehem Iron Co. After the excavation is well under way several hundred bricklayers will be employed, along with carpenters, bridge builders, etc., and work will be pushed night and day. The five mills in course of construction will employ 1,500 men when completed. Nearly all of these men will have to find homes. The car works to be built by the Carnegie Co. just below Homestead, and the Mesta Machine Co.'s works, well under way, will furnish work for 2,000 more men, and homes will have to be had for them.

NEAL BROTHERS, iron and steel merchants, of Pittsburg, have purchased an interest in the Laufman Tin Plate Co.'s works at Butler Junction, Pa., and will put in two additional mills, doubling the capacity of the present works. One mill will be for bright tin and the other for large terne plates, increasing the total output to 16,000 boxes a month. The company will be independent of the American Tin Plate Co., having made arrangements with P. H. Laufman & Co., Ltd., for its supply of black sheets. It is the intention to sell at the price fixed by the American Tin Plate Co.



DEEP-THROAT PUNCHING PRESS.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Boston Cast Steel Casting Co., Portland, Me., has been incorporated with a capital of $15,000 to manufacture metallic substances. The incorporators are: J. W. Dyer, Gorham; C. S. Miller, Brookline, Mass.; H. B. Whall, A. G. Lundin, Boston, Mass.

The Williamsburg Electric Co., Williamsburg, Ky., is reported in the market for a side-crank engine, 75 h. p., a tubular boiler, 80 h. p., and a tubular boiler of 50 h. p., new or second-hand.

"Planer," 58 Central ave., Cincinnati, will buy a 60 x 60 x 12-ft. planer, with improved reversing gear and return of about 80 feet a minute; also a 48 x 48 x 12-ft. planer. Second-hand will answer.

The Radford Foundry & Machine Co., Baltimore, has just been incorporated, with Col. W. J. Kenderdine as president. The capital stock is not to exceed $25,000. The company will manufacture all kinds of castings.

The Byesville Rolling Mill Co. has been organized by capitalists who own coal land near Byesville, which is a town on the Cleveland & Marietta Railroad, about five miles south of Cambridge, O. The company has an authorized capital stock of $150,000 and proposes to erect a mill with four trains of rolls, employing 150 hands.

The Pittsburg Horse Shoe Co., recently incorporated, advise us that it will purchase in connection with its construction work, boilers, engines, blowers, belting, conveyors, pumps, shearing and punching machinery, rolling mill equipment, stokers, conveyors, emery wheels, fire brick and clay, pulleys and shafting, steel castings, chain hoists.

The Cameron & Barkley Co., Charleston, S. C., is in the market for a second-hand pipe-cutting and threading machine for 7-inch and 8-inch pipe.

H. A. Mims, Weldon, N. C., is in the market for second-hand lathes, planer, milling machine and drill press.

New Construction:—

Extensive new construction is in progress at the plant of the Western Electric Co. One building now being finished covers 50 x 180 feet and is 10 stories. Another, 55 x 175 feet, is eight

stories. Plans have been made for another eight-story building, 50 x 124 feet. Another will be seven stories high and 27 x 72 feet. All are of steel and are in addition to the present plant. A second battery of boilers, each of 400 h. p., will be built over those already in use on the ground level without depriving the company of the use of the old boilers. In this construction heavy steel columns will be placed to support the upper floor, whose dimensions will be 44 x 82 feet. On a third floor, above this second battery of boilers, will be built a coal bin of 1,000 tons' capacity. This coal bin will have walls of cement concrete, built between vertical I-beams firmly braced at the top and bottom. This construction avoids the rapid oxidation if metal walls were used to hold the coal. Coal will be conveyed by power to the top of the bin, from which it will be delivered automatically to the boiler furnaces. The total capacity of boilers will be 3,300 h. p. A steel chimney has just been built, 203 feet high and 12 feet internal diameter. The base is of brick work about 50 feet high.

In connection with the Alabama Steel & Shipbuilding Co.'s plant at Ensley, Ala., a foundry and machine shop are being built, and the Tennessee Co.'s work in castings and finishing will be done there. G. B. McCormack, general manager, has charge of purchases.

Additional capacity is planned by the Marion Steam Shovel Co., Marion, O., manufacturer of excavating machinery, cranes, etc The boiler house will be enlarged and more boilers provided; the wood-working department will be increased, and many new electrically driven machines installed. The foundry plant will be more than doubled, by adding a steel department. The present capacity is about 50 tons daily.

The Alabama Steel & Wire Co., Birmingham, Ala., has just placed a contract with the Frank Kneeland Machine Co., of Pittsburg, for the 16-inch and 12-inch trains for its rod mill now under construction at Ensley.

It is stated that a foundry and pattern shop from Chicago is looking in Greenville, Pa., for a location in order to move from Chicago. The proposed plant will employ from 75 to 100 men.

Graff & Co., stove manufacturers, Pittsburg, recently located a new plant at Monongahela City, Pa. The old plant at Sharon, Pa., is to be offered for sale at auction March 16.

A Philadelphia company which proposes to manufacture tubing is negotiating with Beaver Falls, Pa., parties in regard to locating at that point. At a meeting of the Beaver Falls Improvement Association last Thursday night a $5,000 cash bonus and a free site was arranged for but the company, which will guarantee the erection of a plant costing not less than $100,000 and employing 200 hands, wants $7,000 and the balance is being raised by subscription.

Jones & Laughlins, Ltd., Pittsburg, are preparing plans for the erection of two large mills for rolling bar steel, to have a capacity of between 300 and 400 tons of bar steel a day. The mills will be of the continuous type and will be located on land recently acquired adjoining the works. With this additional finishing capacity the firm will have only a small part of its product in the form of billets.

Curtze & Carrick, Erie, Pa., report their work on hand to be up to full capacity and they have had to decline some business offered. They are now constructing an additional building 60 x 160 ft., for foundry purposes.

The new open-hearth steel plant for the Minnesota Iron & Steel Co. at Minneapolis has been completed and will be started soon. About 100 additional men will be employed. With the recent additions the mill will have a capacity of about 40,000 tons a year.

Jas. Leffel & Co., Springfield, O., will build a new foundry which will nearly double their capacity for castings.

Citizens of Andrews, Ind., have raised a fund of $30,000 as a bonus to a steel company which proposes to locate there. The nature of the finished product is not stated. The local association of business men has been in correspondence with the promoters of the enterprise.

The Brightman Mfg. Co., of Millersburg, O., has just made a shipment of four car loads of shafting machinery weighing 60 tons to Sweden, and also has shipped three car loads of turned and polished shafting for export to England, one for Norway and one for Denmark. The company is erecting a new building 60 x 120 feet to increase its output.

The Niles (O.) Boiler Co. has purchased all of the machinery he plant of the Rippel Foundry & Machine Co., Mt. Gilead, O., consisting of nearly 100 tons of improved foundry and machine shop equipment. It will be removed to Niles, O., immediately, where one building 50 x 128 and one building 50 x 112 will be erected in addition to the present boiler and tank shops. The company expects to be in position to turn out castings inside of 60 days.

The New Castle (Pa.) Shovel Co. has completed a deal for eight acres of the Sword farm, at New Castle Junction, on which to locate its new factory. One building is to be 300 x 80 feet, another 120 x 60 feet.

Fires and Accidents:—

The engine in the bar mill at the Brown-Bonnell Iron Co.'s plant, Youngstown, O., ran away last week and was badly wrecked. High water ran into the fly wheel pit, was caught up and thrown over the engine. The belt being slippery came off.

Fire destroyed the iron works and foundry of J. D. Connell, at New Orleans, with loss of $30,000; insured.

The Garry Iron & Steel Roofing Co.'s plant, Cleveland, burned Jan. 19, with $35,000 loss.

General Industrial Notes:—

The Paxton & Vierling Iron Works, Omaha, Nebraska, re-elected its directors last week. The officers for the ensuing year are: W. A. Paxton, president; Robert Vierling, vice-president; Louis Vierling, secretary and treasurer; Adolph J. Vierling, manager. The volume of business was the largest since 1892, with margins small.

The Portage Iron Works, Duncansville, Blair Co., Pa., has increased its capital stock from $250,000 to $400,000 and will make extensions.

The wire drawing plant furnished the Kelly Nail & Iron Co., of Ironton, O., by the Turner, Vaughn & Taylor Co., Cuyahoga Falls, O., was started up under the supervision of C. W. Vaughn, of the latter company, and J. C. Maloney, of New Philadelphia, superintending constructor. It is in all respects a modern plant and the output is about 60 tons a day.

The molding machine originated by the Bryant Iron Co., of Buffalo, is in operation now on radiator work at the Titusville Iron Works, Titusville, Pa. The average product is four castings a minute. The loss through the season has been considerably below 5 per cent, some days below 2 per cent, never above 5 per cent. The machine is fulfilling expectations, and upon completion of the new plant of the Titusville Iron Works in the near future, providing ample facilities for the machine, the company will be in shape to run it continuously 10 hours daily, doing more work with 10 unskilled men than 20 skilled molders ordinarily turn out.

The report that the Johnstown, Pa., tin plate plant would be shut down by the American Tin Plate Co. is denied.

The receivers of the Baltimore & Ohio Railroad have ordered 3,000 drop-bottom gondola cars of 40 tons capacity and 2,000 hopper cars of 50 tons capacity from the Pressed Steel Co. This is in addition to the 1,000 50-ton cars now being built.

A Peoria, Ill., dispatch says that the Peoria Rolling Mill Co. is to install a tin plate plant. The rolling mills went into the hands of Ben. J. Greenhut, son of J. B. Greenhut, president, as receiver about four years ago. The general manager is George J. Gibson. If the new mill is put in it will be operated outside the tin plate consolidation.

Mackintosh, Hemphill & Co., of Pittsburg, are building for the Carnegie Steel Co., Ltd., for the Homestead Steel Works, the largest universal mill ever made. The horizontal rolls will be 30 inches in diameter. This mill will be driven by a direct connected reversing engine, with cylinders 50 x 60 inches. This firm is also building another engine of the same type for the Lorain Steel Co., at Lorain, O., which will have cylinders 55 x 60 inches.

The hot mill department of the Stickney Iron Co. at Canton, Baltimore, has been closed and other departments in turn will be shut down. The new owner, the American Tin Plate Co., can ship tin plate to Baltimore cheaper than it can be manufactured there.

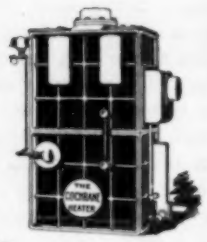
The Ferracute Machine Co., Bridgeton, N. J., recently shipped a geared punching press to Manning, Maxwell & Moor, weighing 12,100 pounds. It will do heavy cutting and punching in sheet metal work. They have also shipped a

"Easy to Clean"

There is a world of meaning in that expression, when applied to a Cochrane Heater and Purifier. Suppose all heaters would give as much purification, one as the other. Wouldn't you want the one that was **easiest** to **clean**? For the scale forming matter—much of it—should remain in the heater, and our Cochranes are just the easiest things to clean out you ever saw.

Another point: Perhaps you have been bothered with or have had to pay for repairs to your heater?

Then you could thoroughly appreciate A COCHRANE HEATER, which requires **none**, and they never deteriorate in their ability to heat water just as hot as the exhaust steam will make it. Address



Harrison Safety Boiler Works, Separator Dep't. **Col. Sta., Philadelphia, Pa.**

large press, weighing 20,600 pounds to Joseph Sankey & Sons, Bilston, Eng., for cutting out armature disks. A large double crank press shipped to Adolphe Janssens, of Paris, weighed 8,900 pounds, and one weighing 15,900 pounds went to the same firm, for use in electrical works.

Miller Brothers & Co., Tradesmen's Building. Pittsburg, have received an order from the American Tin Plate Co. for an annealing furnace at the Monessen Works, Monessen, Pa.; one order from the Midland Steel Co., Muncie, Ind., for a 45-ton open-hearth furnace; an order from the Parkesburg Iron Co., Parkesburg, Pa., for a Lauth heating furnace, and a contract for two Siemens heating furnaces, with Lauth roof, for the Tyrone Iron Co., Tyrone, Pa.

Pittsburg men, it is reported, will lease the Ella Furnace at West Middlesex, Pa., and start it up. It is to be sold at master's sale in March.

Four of the new 12-inch breech-loading rifled coast-defense mortars, which the Niles Tool Works, of Hamilton, O., is making for the Government, have been shipped to the proving-grounds at Sandy Hook.

At the stockholders' meeting of the old Meadow Rolling Mill Co. at Scottdale, Pa., Jan. 19 the following directors were elected: P. F. McCann, John S. Miller, A. L. Keister, John Miller, Charles L. Graft, John W. Ruth and A. C. Overholt. The vote for eighth place was a tie between James A. Bennett and R. K. Hissem. It is thought that as soon as the new officers are elected the strike now on will be settled

The old skelp mill of the Atlantic Iron & Steel Co. at New Castle, Pa., is getting ready to start up after a year's idleness. Some new equipment will be provided.

The Ohio Fire Brick Co., Oak Hill, O., at its recent annual meeting re-elected the officers chosen at its organization last August. The plant is in successful operation, and is making brick for an additional kiln. The company reports a number of orders booked.

The Federal Steel Co. has not taken up its options on the property of the Sheffield Land & Improvement Co., or the Lorain Street Railway, at Lorain, O., and the company will have no interests in Lorain outside of steel, pig iron, coke, etc.

The Wm. B. Pollock Co., Youngstown, O., has been incorporated to succeed Wm. B. Pollock & Co. The capital stock is $100,000. The incorporators are: Wm. B. Pollock, Wm. B. Jones, Chas. W. McClure and Wm. W McKelvey.

W. S. Rockwell & Co., New York, have recently built several of their improved annealing furnaces for the Dominion Wire Mfg. Co., Montreal, Can.

It is reported that H. C. Hamilton, W. H. Williams, Charles L. Umbstaetter, Wm. H. S. McKelvy, and Clarence Byrnes, all of Sewickley, Pa., a suburb of Pittsburg, are interested in a test plant for the manufacture of fuel gas, to be erected at East Liverpool, O.

At a meeting of stockholders in the Pittsburg Reduction Co., the increase of capital stock from $1,000,000 to $1,600,000, mentioned recently in these columns, was authorized. The increase is made to cover the improvements now well under way at the New Kensington and Niagara Falls plants of the company for the manufacture of aluminum.

The Rankin plant of the American Steel & Wire Co. was idle this week owing to the breaking of the piston rod in one of the rod mill engines.

It is stated that Park Bros. & Co., Ltd., Pittsburg, have added a 36-pot crucible steel melting furnace.

A Birmingham, Ala., special says that John W. Harrison has sold a controlling interest in the American Pipe & Foundry Co., which has plants at Chattanooga, Tenn., and at Bridgeport, Anniston and Bessemer, Ala. Samuel Thomas, of New York, and others are named as purchasers.

The stockholders of the Cambria Iron Co. held their annual meeting at Philadelphia Jan. 17, and the lease of the company to the Cambria Steel Co. was approved. The board was re-elected: J. M. Bacon, R. F. Kennedy, Charles S. Price, David Reeves, Powell Stackhouse, E. T. Stotesbury, J. W. Townsend, John Lowber Welsh and R. A. Rancos Wood. The treasurer's report shows that the net earnings for the year were $636,000, and that, after the paying of the April and October dividends of 2 per cent each, there was carried to appliances for handling the trade quickly and economically. With these added facilities the company expect to be able

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the credit of profit and loss $307,407. Such a result under prices below those of to-day is considered quite satisfactory. Under the terms of its lease the Cambria Steel Co. gets the use of $2,400,000 quick assets of the Cambria Iron Co.

The Betts Machine Co., of Wilmington, Del., has just shipped a vertical boring mill to S. Morgan Smith Co. at York, Pa.; a horizontal boring machine to Elektriska Co., at Vesteras, Sweden, and a large slotting machine to the National Tube Works Co., at McKeesport, Pa.

The Bessemer road has completed laying the track between Conneaut, O., and Albion, Pa., with 100-pound rails. This section is part of the former Pittsburg, Shenango & Lake Erie road, which the Pittsburg, Bessemer & Lake Erie road purchased before laying the road from Butler to Bessemer.

The Monongahela plant of the American Tin Plate Co., located on the South Side, Pittsburg, is being put in full operation this week. About two-thirds the capacity had been in operation.

E. E. Erikson, Pittsburg, has a contract with the Dennison (O.) Rolling Mill Co. to erect two blocks of sheet and pair and furnaces and an annealing furnace. These furnaces will all be large, to accommodate sheets of all ordinary size. The company erected a sheet mill in 1897 containing two hot mills and one cold mill, and is now adding two more hot mills and two more cold mills. The mills were contracted for some time ago.

The Dodge Mfg. Co., of Mishawaka, manufacturer of the Dodge patent Independence wood split pulley, patent American system of rope driving, and of a general line of power transmitting machinery and grain elevator machinery, has purchased all of the interests and good will of the Rice Machinery Co, located at 166 to 174 South Clinton st., Chicago. The Dodge Mfg. Co. will continue to carry on the business on South Clinton st. The personnel of the business will be the same as under the Rice Machinery Co., the change being simply in name. The Dodge Mfg. Co. reports excellent business conditions throughout the country. Its various branch stores in New York, Boston, Chicago, and elsewhere are very busy, and the factory at Mishawaka, Ind., continues in operation night and day. The increase in trade was felt so greatly that in the latter months of 1898 it was found necessary to add to the plant at Mishawaka, a new brick building 300 ft. by 80 ft. This has been well fitted with all this year to continue to furnish equipment and supplies in specified time.

The Ferracute Machine Co., of Bridgeton, N. J., has carefully followed for some years past, the extension of the iron trade, and as presses were needed in its various branches, has prepared special patterns. The company makes a great variety of double-crank presses, heavy and light, with or without gearing. The heaviest of these usually give about 100 tons pressure, and are used for large sheet metal work such as corrugating iron for roofing, ceiling plates, etc.; also for various kinds of large household sheet-metal goods, and for cutting out large armature disks for electrical purposes. Special attention has been paid also to punching presses for punching, shearing and cutting very heavy articles. The company has just issued a special circular illustrating a number of its machines, and is about to bring out a handsome catalogue. The company's plant at Bridgeton is running full-handed and on full time.

The Delaney Forge & Iron Co., of Buffalo, has contracts for forgings for a number of vessels now under construction at lake ports. These include the barge building at the American Steel Barge Co.'s yards; a steamer at the Globe Works, Cleveland; and a steamer and barge at the Chicago Shipbuilding Co.'s yard

At Steubenville, O., by order of the court the lease of the Jefferson Iron Works furnace to the Ætna-Standard Iron & Steel Co. was extended to Jan. 1, 1900.

At Clarksville, Tenn., workmen have been cleaning up the ore washer of the Gracey-Woodward iron plant, located on the Clarksville mineral railroad, preparatory to blowing in the furnace, which was lately purchased by the Clarksville Furnace Co.

Closely following the purchase of Maryland steel rails for an Irish railway comes an order to the Maryland Steel Co. from the Caledonian Railway Co., of Glasgow, Scotland. The order is for 1,000 tons. It is likely that a larger one will follow.

The Eagle Iron & Steel Co., Ironton, O., has elected the following directors: H. A. Marting, William Marting, Jr., A. H. Mittendorf, C. H. Ketter, Leo Ebert, W. A. Murdock, S. B. Steece, George B. Davies and Thomas W. Hughes. The board organized by electing H. A. Marting president and general manager; S. B. Steece, vice-president; H. H. Mitten-

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dorf, secretary-treasurer; Thos. W. Hughes and Geo. T. Thomas, assistant managers.

The Hollidaysburg, Pa., rolling mill, that has been idle the last two years, will shortly be put in operation by a company of foreign capitalists.

The following have been elected directors of the Ohio Machine Co., Middleport, O.: Judge McMaster, of Indianapolis, Ind.; R. C. Longstreth, of Langsville, O.; J. S. Bogges, Lewis Haag and John Reuter, of Middleport.

At the annual meeting of the stockholders of the Walker Electrical Co., last week, in Jersey City, the following board of directors was elected: Edwin S. Carpenter, W. A. Esselstyn, George W. Hebard, P. F. Kobbe, Charles A. Terry, B. H. Warren and W. F. Zimmermann. The following officers were subsequently chosen: B. H. Warren, president; P. F. Kobbe, first vice-president; George W. Hebard, second vice-president; Edwin S. Carpenter, treasurer; Charles A. Terry, secretary and assistant treasurer; J. H. Jones, assistant secretary.

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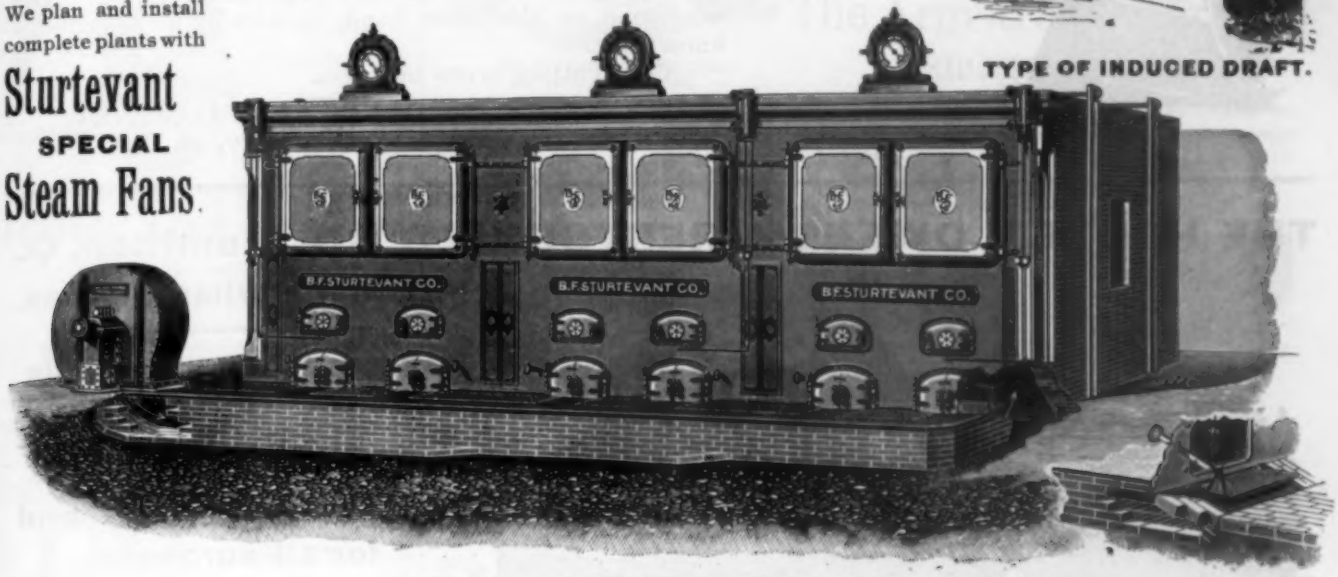

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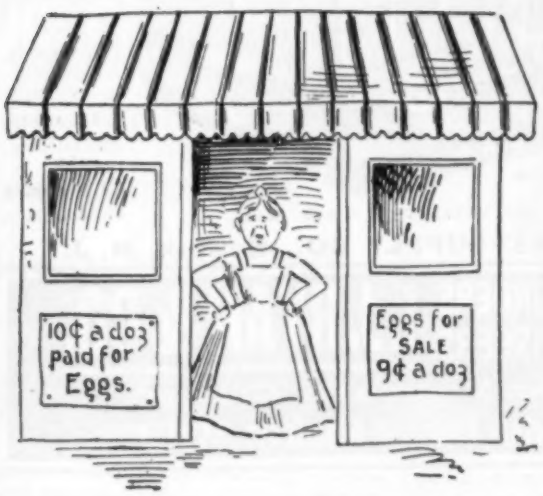

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"But how on earth can you make anything that way?" she was asked.

"Sure, by doin' a ver-r-ry large business."

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They lose more money buying supplies than they make as profit on their castings.

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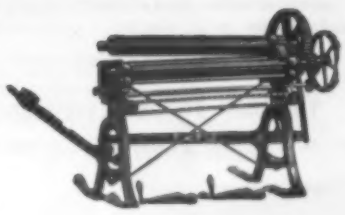

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has his place in the world, but it is usually at the tail of the procession, because, while he says he is open to conviction, he has never seen the man who could convince him. We should hesitate to approach such a man with the statement that cut gears were better in every way than cast, as he would resent being told anything. The wise man, on the other hand, benefits by his neighbor's knowledge.

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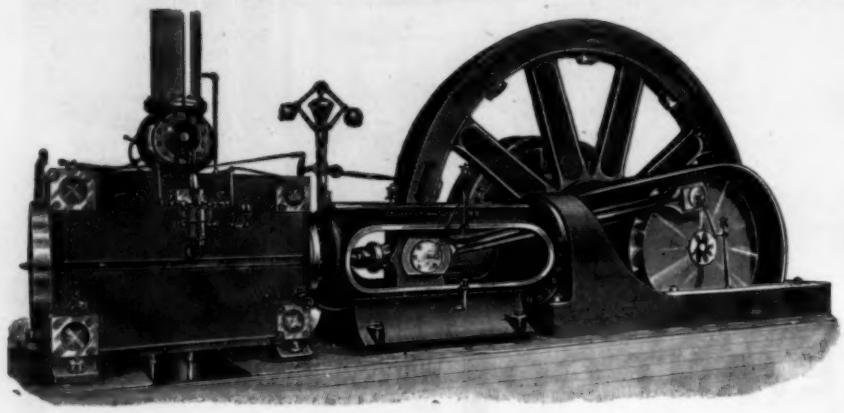

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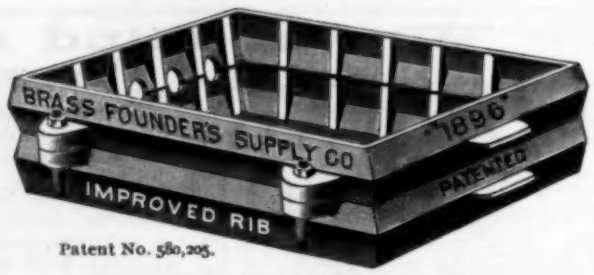

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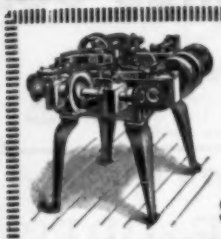

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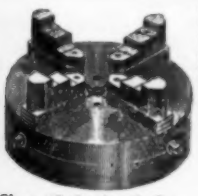

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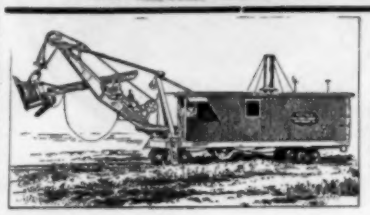

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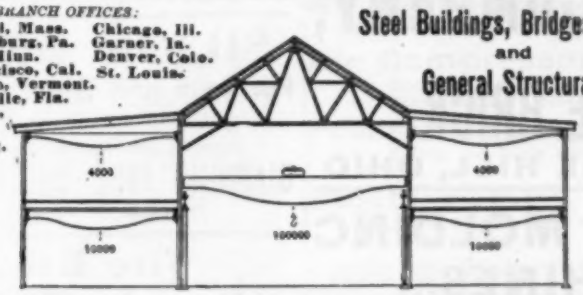

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

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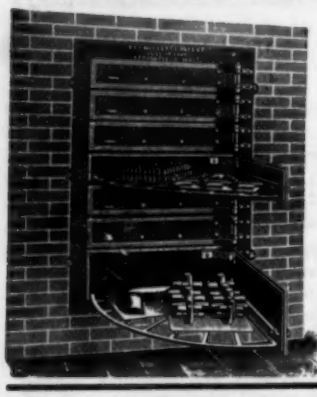

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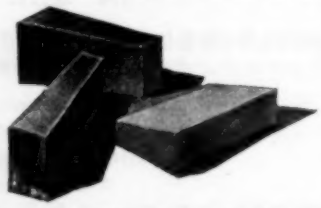

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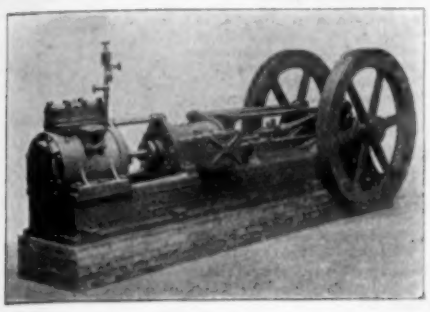

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Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.

Castings (Aluminum)—
J. J. Ryan & Co., Chicago, Ill.

Castings (Brass)—
J. J. Ryan & Co., Chicago, Ill.

Castings (Bronze)—
J. J. Ryan & Co., Chicago, Ill.

Chain Hoists—
Edwin Harrington Son & Co., Philadelphia, Pa.
Reading Crane & Hoist Works, Reading, Pa.

Chain Belting—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.

Channelers—
The Ingersoll-Sergeant Drill Co., New York.

Charcoal—(Lump, powdered, granulated)—
The S. Obermayer Co., Cincinnati, O.

Chemists—
Dickman & MacKenzie, Chicago, Ill.
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
Wellman Seaver Co., Cleveland, O.
Benedict Crowell, Cleveland, O.
John T. Jones & Co., Chicago, Ill.
J. Blodgett Britton & Co., Warrenton, Va.

Chilled and Sand Rolls—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.

Chucks—
Skinner Chuck Co., New Britain, Conn.
Massey Vise Co., Chicago, Ill.

Coal Cutters—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

Coal Screens—
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

Coal and Coke—
Forster, Waterbury & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Washington Coal and Coke Co., Pittsburg, Pa.

Coal Mining Machinery—
Jeffrey Mfg. Co., Columbus, O.

Conveyors—
Jeffrey Mfg. Co., Columbus,O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.

Comparometers—
Vulcan Mfg. Co., Pittsburg, Pa.

Compressed Air Shop Tools—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

Compression Couplings—
Geo. B. Sennett Co., Youngstown, O.
The Aultman Co., Canton, O.

Core Ovens—
Millett Core Oven Co., Brightwood, Mass.

Corrugated Iron—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
Edwin Harrington, Son & Co., Philadelphia.
Wellman-Seaver Engineering Co., Cleveland, O.
Reading Crane & Hoist Works, Reading, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

Crucibles—
The S. Obermayer Co., Cincinnati, O.

Cupolas—
The S. Obermayer Co., Cincinnati, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.

Dies—
Ferracute Machine Co., Bridgeton, N. J.

Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Drill Grinders—
J. Wendell Cole, Columbus, O.

Drill Presses—
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Fox Machine Co., Grand Rapids, Mich.
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Tool & Supply co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

Drop Forgings—
Wyman & Gordon, Worcester, Mass.

Drop Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Fox Machine Co., Grand Rapids, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Long & Allstatter Co., Hamilton, O.
E. Konigslow & Bro., Cleveland, O.

Drop Hammers—
Baush & Harris Machine Tool Co., Springfield, Mass.

Dry Kilns—
B. F. Sturtevant Co., Boston.

Dynamos—
Jeffrey Mfg. Co., Columbus, O.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.

Elevators—
The Lane & Bodley Co., Cincinnati, O.

Elevating and Conveying Machinery—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.

Emery and Corundum Wheels—
J. Wendell Cole, Columbus and Chicago.
The Hanson & Van Winkle Co., Newark, Chicago, New York.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O.
Vitrified Wheel Co., Westfield, Mass.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
The Hanson & Van Winkle Co., Newark, Chicago, New York.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O.

Engineers and Contractors—
Wellman Seaver Engineering Co., Cleveland.
Heyl & Patterson, Pittsburg, Pa
Meehan Boiler & Construction Co., Lowellville Ohio.
E. R. Erickson, Pittsburg, Pa.
Benedict Crowell, Cleveland, O.
John T. Jones & Co., Chicago, Ill.
Riter-ConleyMfg. Co., Pittsburg, Pa.
Rarig Engineering Co., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.

Engine Packing—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

Engineers' Supplies—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
John M. Russell & Co., Springfield, o.

Engine Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington & Son Co., Philadelphia

Engines (Oil)—
The Aultman Co., Canton, O.

Engines (Steam)—
Wm. Tod & Co., Youngstown, O.
B. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Lane & Bodley Co., Cincinnati, O.
Geo. B. Sennett Co., Youngstown, O.
Rarig Engineering Co., Columbus, O.
The Aultman Co., Canton, O.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.
Eclipse Electrotype & Eng. Co., Cleveland, O.

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Harrison Safety Boiler Works, Philadelphia, Pa.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield.
Dover Fire Brick Co., Cleveland, Pa
Diamond Fire Brick Works, Akron, O.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati, O
Chicago Fire Clay Product Co. Chicago, Ill
Columbia Fire Clay Co., Cleveland, O
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit Mich.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Fluor Spar
James Irwin & Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa

Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Geo. B. Sennett Co., Youngstown, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
W. A. Wood Mowing & Reaping Machine Co., Hoosick Falls, N. Y.

Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Heber Wells, New York City.
Millett Core Oven Co., Brightwood, Mass.
Hanson McDowell, Chicago, Ill.
Cleveland Facing Mill Co., Cleveland, O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
James Irwin & Co., Pittsburg, Pa.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Standard Sand Co., Everett, O.
Columbia Fire Clay Co., Cleveland, O.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Diamond Fire Brick Works, Akron, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.

Friction Metal—
C. H. Besly & Co., Chicago, Ill.
North American Metaline Co., Long Island City, New York.

Swarts Metal Refining Co., Chicago, Ill.

Furnaces—
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.

Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizing Pots—
Wm. B. Pollock & Co., Youngstown, O.

Gas Burners—
American Gas Furnace Co., New York City.

Gas Furnaces—
American Gas Furnace Co., New York City.

Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.

Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,

Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
Brass Founders' Supply Co., Newark, N. J.

Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

Hangers—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.

Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.

Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton O.

Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.

Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.

Hotels—
United States Hotel Co., Cleveland, O.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Injectors—
C. H. Besly & Co., Chicago, Ill.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Pittsburg Bridge Co., Pittsburg, Pa.
Riter-Conely Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.

Iron Working Tools—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
John Adt & Son, New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Chicago Die and Machine Works, Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Massey Vise Co., Chicago, Ill.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

Ladles—
The S. Obermayer Co., Cincinnati, O.

Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Bickford Drill & Tool Co., Cincinnati, O.

Machinery Name Plates—
August Becker, Boston, Mass.

Machinists' Tools and Supplies—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Edwin Harrington Son & Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Massey Vise Co., Chicago, Ill.

Machine Screws—
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.

Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Malleable Iron Castings—
W. A. Wood Mowing & Reaping Machine Co., Hoosick Falls, N. Y.

Manufacturing Chemists—
James Irwin & Co., Pittsburg, Pa.

Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co Bridgeport, O
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.

Metal Bearings—
North American Metaline Co., Long Island City, N. Y
C. H. Besly & Co., Chicago, Ill.

Milling Machines—
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.

Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.

Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.

Mine Pumps—
Fred M. Prescott Steam Pump Co, Milwaukee, Wis.

Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Standard Sand Co., Everett, O.
Newport Sand Bank Co., Newport, Ky.

Molders' Tools—
The S. Obermayer Co., Cincinnati, O.

Name Plates—
August Becker, Boston, Mass.

Nickel Plating Outfits—
The Hanson & Van Winkle Co., Newark, Chicago, New York.
Northampton Emery Wheel Co., Chicago, Ill.

Nuts and Bolts
Rockford Bolt Works, Rockford, Ill.
Upson Nut Co., Cleveland, O.

Oilless Bearings—
North American Metaline Co., Long Island, City, N. Y.
C. H. Besly & Co., Chicago, Ill.

Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.

Packing—
C. H. Besly & Co., Chicago, Ill
Jenkins Bros., New York City.

Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York, City.

Pattern Letters—
Heber Wells, New York City.

Pattern Works—
Gobeille Pattern Co., Cleveland O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.

Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Hickman & Williams, Chicago, Ill.
Shenango Valley Steel Co., New Castle, Pa.
Spearman Iron Co., Sharpsville, Pa.

Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.

Planers—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.

Plates—
Enterprise Boiler Co., Youngstown, O.

Plumbago—
The S. Obermayer Co., Cincinnati, O.

Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.

Pneumatic Appliances—
Clayton Air Compressor Works, New York.

Pneumatic Tools —
American Pneumatic Tool Co., New York City.

Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.

Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.

Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
The Long & Allstatter Co., Hamilton, O.
Ferracute Machine Co., Bridgeton, N. J.
E. Konigslow & Bro. Cleveland, O.

Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.

Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
The Long & Allstatter Co., Hamilton, O.
Ferracute Machine Co., Bridgeton, N. J.
E. Konigslow & Bro. Cleveland, O.

Pressure Gauges—
The Bristol Co., Waterbury, Conn.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.

Pumps (steam)—
The Edward P. Allis Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee, Wis.

Punches—
The Long & Allstatter Co., Hamilton, O.
Ferracute Machine Co., Bridgeton, N. J.
E. Konigslow & Bro. Cleveland, O.

Pyrometers—
Edward Brown, Philadelphia, Pa.
Uehling, Steinbart & Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.

Rivets—
Champion Rivet Co., Cleveland, O.

Riveted Steel Pipe—
Wm. B. Pollock & Co. Youngstown, O.

Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

Rolling Mill Machinery—
Rarig Engineering Co., Columbus, O.

Roofs—
Shiffler Bridge Co., Pittsburg.
Berlin Iron Bridge Co., East Berlin, Conn.
Pittsburg Bridge Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.

Sand—
David Tod Sand Co., Youngstown, O.

Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.

Saws—
Peter Gerlach & Co., Cleveland, O.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Rockford Bolt Works, Rockford, Ill.

Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.

Shapers—
Baush & Harris Machine Tool Co., Springfield, Mass.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
The Long & Allstatter Co., Hamilton, O.
Ferracute Machine Co., Bridgeton, N. J.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.

Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.

Special Machinery—
Edwin Harrington Son & Co., Philadelphia.
Q & C Co., Chicago, Ill.
A. H. Nilson Machine Co., Bridgeport, Conn.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.

Stand Pipes—
Wm. B. Pollock & Co., Youngstown, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.

Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Otis Steel Co., Cleveland, O.
Miller, Wagoner, Fieser & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.

Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Hanson McDowell, Chicago, Ill.

Steel Plants—
Wm. B. Pollock & Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
Shenango Valley Steel Co., New Castle, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.

Semi-Steel—
Hanson McDowell, Chicago, Ill.

Stokers—
Playford Stoker Co., Cleveland, O.

Tanks—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
Wm. B. Pollock & Co., Youngstown, O.
Rarig Engineering Co., Columbus, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.

Tank Cars—
Wm. B. Pollock & Co., Youngstown, O.

Tin and Terne Plates—
B. P. Crane & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.

Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.

Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

Tubes—
National Tube Works, McKeesport, Pa.

Tube Welding—
S. Fix Sons, Cleveland, O.

Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.

Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Ventilating Fans—
B. F. Sturtevant Co., Boston, Mass.

Wire Machinery—
John Adt & Son, New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.
A. H. Nilson Machine Co., Bridgeport, Conn.

Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.
Shenango Valley Steel Co., New Castle, Pa.

Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.

Wrought Pipe—
National Tube Works, McKeesport, Pa.

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BRÆBURN STEEL COMPANY, Bræburn, Pa.
MANUFACTURERS OF
FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, F. B. Hasbrouck, R. P. Kelly, Sec'y. and Treas.

MORE WEAR from your tools
.....Almost no **STEEL EXPENSE**
NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.
Cleveland Warehouse, 97 Water St.

ESTABLISHED 1865 ✻ INCORPORATED 1889.
CRESCENT STEEL
CRESCENT STEEL CO.
480 PEARL ST. NEW YORK — PITTSBURGH, PA. — 64 & 66 S. CLINTON ST. CHICAGO.

La BELLE STEEL CO., Pittsburgh, Pa.
MANUFACTURERS OF FINE
CRUCIBLE CAST TOOL STEEL.
SPECIAL GRADES FOR ALL PURPOSES.
BYRON H. WHITE,
Western Selling Agent.
OFFICE AND WAREHOUSE: **68 and 70 South Canal St., Chicago.**

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"ECLIPSE" COLD DRAWN SHAFTING
FITZSIMONS & CO., CLEVELAND, OHIO
BYRON H. WHITE WESTERN SELLING AGENT
WAREHOUSE & OFFICE 68—70 SO. CANAL ST. CHICAGO

BYRON H. WHITE, Western Selling Agent,
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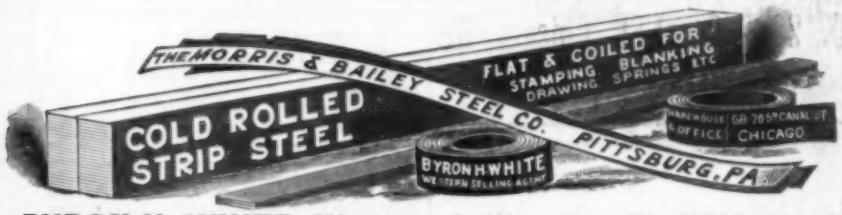

THE MORRIS & BAILEY STEEL CO.
COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING DRAWING BLANKING SPRINGS ETC
BYRON H. WHITE
WESTERN SELLING AGENT
PITTSBURG, PA.
WAREHOUSE & OFFICE 68-70 CANAL ST. CHICAGO

BYRON H. WHITE, Western Selling Agent, CHICAGO.

FIRE BRICK

Holmes, Strachan & Co.,
Manufacturers and Shippers
Steel
Savage Mountain
Holmes
Best made for Malleable Rolling Mill Furnaces and Cupola Linings.
DETROIT, MICH.

OUR NEW
University Bicycle Saddle
WILL SOON BE READY.
LOOK FOR IT.
Parkhurst & Wilkinson Co.,
146-164 Kinzie Street, CHICAGO.

Don't Waste Money in Your Pattern Shop.
THE GOBEILLE PATTERN CO., Cleveland.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	3.65
No. 1 Specular, Bessemer	3.01@3.35
No. 1 Bessemer hematite	2.75@3.15
Hematites No. 1 non-Bessemer	1.90@2.10
No 1. Specular, non-Bessemer	2.00@2.40
Mesabi Bessemer	1.80@2.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	11 15
No. 1 Strong Foundry	11 00@11 25
No. 2 Strong Foundry	10 50@10 75
Gray Forge, red short	10 50
Gray Forge, neutral	10 25
No. 1 American Scotch	11 15@11 40
No. 2 American Scotch	10 65@10 90
Lake Superior Charcoal	11 50@12 00
PITTSBURG:	
No. 1 Foundry	$11 00@11 30
No. 2 Foundry	10 50@10 60
Gray Forge	9 75@9 85
White and Mottled	9 50
Warm Blast Charcoal	13 00@13 50
Cold Blast Charcoal	22 00@26 00
Bessemer	11 15
CHICAGO:	
Lake Superior Charcoal	$11 50@$13 00
Local Coke Foundry No. 1	11 50@12 00
Local Coke Foundry No. 2	11 00@11 50
Local Coke Foundry No. 3	10 75@11 00
Local Scotch Foundry No. 1	11 50@12 00
Local Scotch Foundry No. 2	11 00@11 50
Local Scotch Foundry No. 3	10 75@11 00
Southern Coke No. 1	@10 85
Southern Coke No. 2	@10 60
Southern Coke No. 3	@10 10
Southern No. 1 Soft	@10 80
Southern No. 2 Soft	@10 65
Southern Silveries	11 25@11 50
Jackson Co. Silveries	12 50@14 50
Ohio Silveries No. 1	@
Ohio Strong Softeners	12 00@12 50
Alabama Car Wheel	15 00@16 00
Malleable Bessemer	11 50@12 00
Coke Bessemer	11 50@12 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$ 10 50
Southern Coke No. 2 and No. 1 Soft	10 25
Hanging Rock Coke, No 1	11 00
Hanging Rock Charcoal No. 1, Fdy	15 50@16 00
Tennessee Charcoal No 1	14 00@14 25
Jackson County Silvery No 1	12 50@12 75
Southern Coke, Gray Forge	9 25
" " Mottled	9 25
Standard Georgia Car Wheel	14 25@1500
Tennessee " "	13 00@14 00
Lake Superior " "	14 25@14 50
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	11 00@11 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 50@11 75
Ohio Strong Softener No. 1	11 50@11 75
Jackson Co. Silvery No. 1	14 00
Lake Superior Charcoal	12 00@12 50
Southern Soft No. 1	12 25
" " No. 2	12 00
ST. LOUIS:	
Southern Coke No 1	$10 50
Southern Coke No. 2	10 25
Southern Coke No. 3	9 75
Southern Gray Forge	9 25
Southern Charcoal No. 1	20 50
Missouri Bessemer	13 00
Lake Superior Car Wheel	13 00
Ohio Softeners	14 00
Southern Car Wheel	13 00

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$14 00
Old steel rails (6 ft. and over)	9 75
Old steel rails (6 ft. and under)	9 75
Old car wheels	11 00
	Net Tons
No. 1 R. R. wrought scrap	$11 50
Mill scrap	8 50
No. 1 Machine cast scrap	8 25
Iron axles	15 50
Axle turnings	8 00
Wrought turnings (free from cast)	7 00
Cast borings	5 50
Uncut wrought iron boilers	5 00
Steel boiler plates	8 00
Grate bars	5 50
Pipes and flues (clean)	7 50
Tank iron	8 00
Hoop and band iron	7 50
Sheet iron	5 25
Wrought drillings	6 50
Malleable iron	8 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.40c
Angles	1.30c
Tees	1.40c
Universal Plates	1.40@1.45c
Sheared Plates	1.45c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1⅜	1.05 Base.
2 to 2⅜	.20 extra.
3 to 3⅜	.50 "
3⅜ to 4	.80 "
4⅛ to 4⅜	1.00 "
4⅜ to 5	1.30 "
5⅛ to 6	1.80 "
5⅜ to 6⅛	2.00 "

VITRIFIED EMERY AND CORUNDUM WHEELS. . .

FOR

Foundry and Machine Shop Work.

SOLD BY
Weed & Co., Buffalo, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, O.
Machinist Supply Co., Chicago, Ill.
Sligo Iron Store Co., St. Louis, Mo.

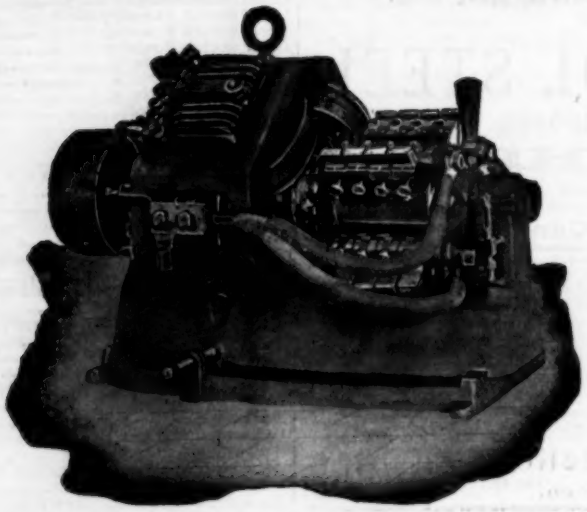
CAN BE RUN WET OR DRY.

VITRIFIED EMERY WHEEL CO.,
Westfield, Mass.

Eddy Dynamo Electro-Plating Machines

FOR

BICYCLE PLATING PLANTS.



NORTHAMPTON EMERY WHEEL CO., 20 S. Canal St., Chicago, Ill.

EXCLUSIVE WESTERN SELLING AGENTS.

The Chicago & North-Western Railway

REACHING with its 7,900 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and and Soft Lumber Districts located in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

M. HUGHITT,
General Freight Agent,
CHICAGO.

A paper that is paid for and read—THE IRON TRADE REVIEW.

6⅝ to 7¼	2.50 extra
¾ to ⅞	.10 "
⅝ to 11-16	.30 "
⅞ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to [illegible] 32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1½ to 4 x ⅜ to 1	1.05 Base
4½ " 6 x ⅜ to 1	.10 extra
6½ " 8 x ⅜ to 1	.60 "
8½ " 10 x ⅜ to 1	.80 "
1⅜ " 4 x 1 1-16 to 1½	.30 "
4½ " 6 x 1 1-16 to 1½	.40 "
6½ " 8 x 1 1-16 to 1½	.60 "
8½ " 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅜ to 2	.50 "
4½ " 6 x 1⅜ to 2	.60 "
6½ " 8 x 1⅜ to 2	.80 "
8½ " 10 x 1⅜ to 2	1.00 "
2 to 4 x 2⅜ to 3	.60 "
4½ " 6 x 2⅜ to 3	.80 "
6½ " 8 x 2⅜ to 3	1.00 "
1⅜ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅞	.20 "
⅝ to 15-16 x ⅜ to ¾	.40 "
⅝ to 11-16 x ⅜ to ¾	.50 "
½ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅜ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¾ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes o Light Bands.

Oval Iron.

⅝ to 1⅜	.40 extra.
¾ to 13-16	.50 "
⅝ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
⅝ to 11-16 x ⅜	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅝ to 11-16	.90 "
½ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

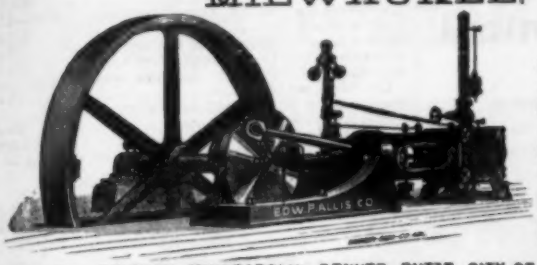
Steel Bands.

Width In Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.
		Extras.
1⅛ to 6,	" 10, 11, 12 or 1/16"	.05 per 100 lbs.
1 to 1⅜,	" 7, 8, 9 or 3-16"	.10 "
1 to 1¾,	" 10, 11, 12 or 1/16"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or 1/16"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or 1/16"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10, 11, 12 or 1/16"	.45 "
½,	Nos. 7, 8, 9 or 3-16"	.55 "
½,	" 10, 11, 12 or 1/16"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-19	" 10, 11, 12 or 1/16"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or ¼"	1.05 "

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.	
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras.
7-16 to 2,	" 17, 18, and 19	.05 per 100 lb
7-16 to 2,	" 20	.10 "
7-16 to 2,	" 21	.15 "
7-16 to 1¾,	" 22	.25 "
¼ to 1¾,	" 13, 14 and 15	.05 "
¼ to 1¾,	" 16, 17 and 18	.10 "

THE EDWARD P. ALLIS COMPANY
MILWAUKEE, WIS.



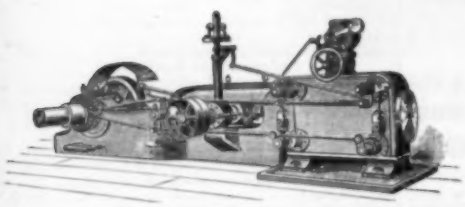
MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

NEW YORK. CHICAGO. MINNEAPOLIS. DENVER. BUTTE. CITY OF MEXICO. SAN FRANCISCO. PITTSBURG.

THE LANE & BODLEY CO.,
CINCINNATI, OHIO.



Engines,
ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

The Geo. B. Sennett Co., Youngstown, Ohio,

MANUFACTURERS OF

Sennett Compression Coupling

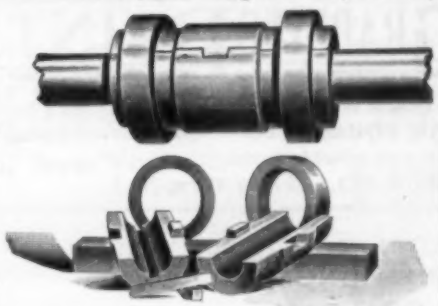
And Other Specialties.

We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.
We make also the

SENNETT ENGINE

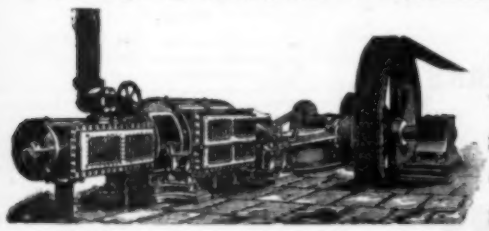
20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



WILLIAM TOD & CO.
YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

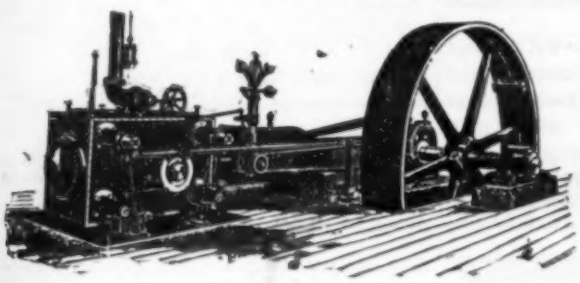
Williams Improved Vertical Engines

For Direct Electrical and all High Class Work.

39-41 Cortland St., N. Y. E. F. WILLIAMS

Park Building, Pittsburg, SEWARD S. BABBITT.

....The Rarig Engineering Company,
COLUMBUS, OHIO,



MANUFACTURERS OF

Heavy Duty Corliss

BLOWING - STATIONARY HAULAGE - HOISTING - Engines.

Boilers, Tanks, Steel Chimneys Structural Iron Work.

1⅛ to 1¼,	"	19 and 20	per 100 lbs.
1⅛ to 1¼,	"	21	.20 "
1⅛ to 1¼,	"	22	.30 "
13-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞, Nos.		13, 14 and 15	.20 "
⅞, "		16, 17 and 18	.25 "
⅞, "		19 and 20	.30 "
⅞, "		21	.35 "
⅞, "		22	.45 "
¾ and 13-16 Nos.		13, 14 and 15	.30 "
¾ and 13-16 "		16, 17 and 18	.35 "
¾ and 13-16 "		19 and 20	.40 "
¾ and 13-16 "		21	.45 "
¾ and 13-16 "		22	.50 "
¾ and 13-16 "		23	.60 "
11-16, Nos.		13, 14 and 15	.35 "
11-16, "		16, 17 and 18	.40 "
11-16, "		19 and 20	.50 "
11-16, "		21	.60 "
11-16, "		22	.70 "
11-16, "		23	.80 "
⅝, Nos.		13, 14 and 15	.40 "
⅝, "		16, 17 and 18	.45 "
⅝, "		19 and 20	.55 "
⅝, "		21	.65 "
⅝, "		22	.75 "
⅝, "		23	.85 "
9-16, "		13, 14 and 15	.45 "
9-16, "		16, 17 and 18	.50 "
9-16, "		19 and 20	.60 "
9-16, "		21	.70 "
9-16, "		22	.80 "
9-16, "		23	.90 "
½, "		13, 14 and 15	.55 "
½, "		16, 17 and 18	.60 "
½, "		19 and 20	.70 "
½, "		21	.80 "
½, "		22	.90 "
½, "		23	1.00 "
7-16, "		13, 14 and 15	.80 "
7-16, "		16, 17 and 18	.90 "
7-16, "		19 and 20	1.00 "
⅜, "		13, 14 and 15	1.00 "
⅜, "		16, 17 and 18	1.10 "
⅜, "		19 and 20	1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2
No. 25-26	2 20
No. 27	2 30

English Tool Steel.

Jessop's	15¼c
Hobson's "Best"	15½c
" "Choice"	13c

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special.

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ½ thick	.08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	.08
9-16 to ½ in. "	.08
7-16 to ⅝ and 2⅛ to 3 in.	.09
3⅛ to 4 in.	.09½
⅝ to 11-16 and 4⅛	.10
⅝ to 6 in.	10½
¼ to 9-32 and 6⅛ to 7 in	.11
1 in.	.13

Burden Boiler Rivets.

⅛, ⅜, 11-16 and ¾ inches diameter	3 60
Bridge ⅛, ⅜, 11-16 and ¾ inch diam.	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black, base, and 10 per cent	78
Butt " " " "	72
Lap " galv. " "	70
Butt " " " "	67
Boiler tubes 2½" and smaller	72½
Boiler tubes 2½" and larger	75
Casting screw and socket joint	dis. 50
Casing inserted joint	dis. 45

MACHINERY SUPPLY MARKET.

[From Store, Cleveland.]

Anti-Friction Metals.

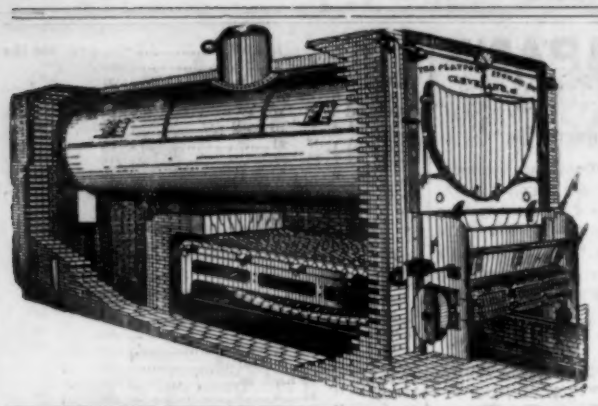
Magnolia Anti-Friction Metal, 25 cts. per lb., f. o. b. New York or Chicago.
No Name Metal, 15 cts. per lb., f. o. b. New York or Chicago.
Mystic Metal. 10 cts. per lb., f. o. b. New York o Chicago.

Anvils.

American	₩ lb 9@11
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's	dis
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50



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Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

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Iron Clad Paint Co.

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IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

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FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

FOR GREAT TENSILE STRENGTH, ELASTICITY AND ELONGATION, COUPLED WITH UNUSUAL NON-CORROSIVE QUALITIES,

Castings and Propeller Wheels

MADE FROM

PARSONS MANGANESE BRONZE

CANNOT BE EXCELLED. WRITE FOR PARTICULARS.

SOLE MAKERS,

THE WILLIAM CRAMP & SONS

Ship and Engine Building Company,

PHILADELPHIA, PA.

THE 1898 EDITION OF THE Iron and Steel Directory

Published by
The American Iron and Steel Association.

Will be sent postpaid by *The Iron Trade Review* at $7. Ready now.

Is a thorough revision of the list of blast furnaces, rolling mills, Bessemer and Open-Hearth steel works, plate and sheet mills, nail mills, tin plate mills, malleable, cast iron pipe and wrought pipe works, car wheel and locomotive works, with many new lists of works in other lines.

Belting.

Boston Belting Co.'s standard	dis 70 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@1
Standard	dis 10@1
Morse	dis 10 to 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 1

Drill and Drill Sockets.

Twist Drills	
Morse Taper&Straight Shank to 1½"	dis 50 &10 to 60
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60@60&5
Cleveland " "	dis 60@60&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, C. F
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	c
10 lb cans less than 10	10 c	10 c	½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Crant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 50
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 2
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 55
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	10c
" " " " over 5 lbs	8c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	13½	11⅛	8½	6	5⅜	5⅛	
Washers	9	8	7	5	4⅜	4⅛	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, ₩ keg, base.

Car lots $1.30

Less than car lots $1.40

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz	dis 10@10&15

Picks.

Railroads, 5 to 6 lbs	dis $12 60
" 6 to 7 lbs	dis $13 60

Established 1853.

Refined Malleable Iron Castings

MANUFACTURED BY

Our Characteristics:
Uniformity,
Strength,
Finish,
Prompt Deliveries.

Reverberatory Furnaces only.
Annealed by Improved method.
Annual Capacity 6000 tons.

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(Seymour, Santvoord & Danforth Geer, Receivers.)

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WHEN YOU ARE TOLD THAT JENKINS '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight, ¼" "Jenkins '96." 11 lbs. to the square yard.
" " ¼" Red Packing, 14 " " " " " "

At 50c. per pound "JENKINS '96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS., New York, Boston, Philadelphia, Chicago.

THE AMERICAN PNEUMATIC TOOL CO.

844 Washington St., New York City.

PNEUMATIC TOOLS

For Chipping, Caulking and Beading

If you want a pneumatic tool which will calk a six foot boiler. ⅝ in. stock, 3 courses, all circular and horizontal seams, both heads, and bead all tubes in less than 5 hours with 60 lbs. air pressure. (Kendall & Sons, Cambridgeport, Mass., caulked a six foot boiler to 150 test in 2 hours and forty-five minutes.)

ORDER OUR "F" TOOL.

If you want a tool which will calk up to 1¼ in. and will chip ⅜ in x11-16 in. x1¾ per minute order our "G" Tool. We ship on 10 days trial with guarantee.

DIRECTORY

OF

Iron and Steel Works of United States,

Published by The American Iron and Steel Association,

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IRON TRADE REVIEW,

Offices: Pittsburg, Cleveland, Chicago.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

Rivets.

Iron, Thousand, list November 1, 1894	dis 60@60
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894	dis 60@65
Copper	dis 50@50&15

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

List, Apr. 9, 1894

Brass	dis 35c
Copper	dis 35c
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ℔ lb dis 30

The Iron Founder

A comprehensive treatise on the art of molding, including chapters on core making, loam, dry sand and green sand molding, also crystallization, shrinkage and contraction of cast iron and a full explanation of the science of pressures in molds, added to which are formulas for mixtures of iron, tables, rules and miscellaneous information. By SIMPSON BOLLAND. Illustrated with over 300 engravings. 12mo.; cloth $2.50

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AND ALL POINTS
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For time table and other information, address
FRANK J. REED, General Passenger Ag't,
CHICAGO.

Cleveland, Lorain & Wheeling
Railroad Company.

Time Table effective May 15th, 1898.
Cleveland Depot: Foot of South Water Street.
Elyria Depot: Huron St., West Side.

South Bound.			Central Standard.		North Bound.	
15	13	11	Lorain Branch	12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria.....	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester.....	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester.....	7:29	10:49	6:19
6:52	3:35	8:30	Medina.....	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling.....	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover.	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport....	.....	6:05	1:40
.....	8:25	.....	Bellaire.....	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

Trains 1, 2, 5 and 6 daily between Cleveland and Urichsville. All other trains daily except Sundays. Electric cars between Bridgeport and Wheeling, and Bridgeport and Martins Ferry and Bellaire. Consult agents for general information as to the best routes and passenger rates to all points. M. G. CARREL, G. P. A., Hickox Bldg., Cleveland, O.

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The Cleveland Terminal & Valley R. R. Co
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Valley Jctn. & Way Stations..	*6:25 P M	*7:25 A M
Marietta, Wheeling & Chicago	†9:25 P M	†7:25 A M
Cleveland Press Special.....	†9:25 P M	†2:00 P M
Akron, Canton & Wheeling .	*10:20 A M	*3:30 P M
Akron, Canton & Chicago.....	*8:05 A M	*6:35 P M
Akron, Canton & Marietta,...	†2:10 P M	†11:00 A M
Pittsburg, Washington, D. C., & Baltimore.....	*11:30 A M	†2:00 P M
Akron Theatre Train.....		†11:10 P M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago, also Cleveland and Baltimore.

When you write to firms advertised in our columns, please mention the fact that you took their address from our paper. They will thank you for it.

DIRECTORY

To the Iron and Steel Works of the United States for 1898.

PUBLISHED BY
THE AMERICAN IRON AND STEEL ASSOCIATION.

Thoroughly Revised. Price, Seven Dollars.

The American Iron and Steel Association has just completed a thorough revision of its Directory to the Iron and Steel Works of the United States, bringing down to April, 1898, a description of these works. It also contains a complete Directory to many leading industries which are large consumers of iron and steel. This edition, which is the fourteenth that has been issued, embraces more complete details of all the iron and steel works of the United States, and of industries which are large consumers of iron and steel, than any preceding edition. It retains all the old features of preceding editions and contains many new features.

In the edition for 1896 there was given for the first time a complete list of Malleable Iron Works in the United States, and to this new feature there are now added complete lists of the Rail Mills, Structural Mills, Steel Casting Works, Bolt, Nut and Rivet Works, Chain Works, Seamless Tube Works, and Riveted Pipe Works—all new features.

The lists of Plate and Sheet Mills and of Tin Plate and Stamping Works are much more complete than in previous editions. The names and location of all the works described are given in alphabetical order, followed by a description of their character, capacity and products, with the names of the principal officers, etc., including the names of selling agents. This edition makes a cloth-bound book of nearly 400 well-printed pages—many more than in any previous edition. It contains a complete list of all the

Blast Furnaces,
Rolling Mills,
Bessemer Steel Works,
Open-Hearth Steel Works,
Crucible Steel Works,
Plate and Sheet Mills,
Rail Mills,
Structural Mills,
Steel Casting Works,
Cut-Nail Works,
Tin Plate Works,
Stamping Works,
Forges and Bloomaries,
Wire Rod and Wire Mills,
Wire Nail Works,
Iron and Steel Bridge Builders,
Iron and Steel Ship Builders,
Horse-Nail Works,
Locomotive Works,
Malleable Iron Works,
Cast Iron Pipe Works,
Cast Iron Soil and Plumbers' Pipe Works,
Wrought Iron, Wrought Steel and Riveted Pipe Works,
Seamless Tube Works,
Chain Works,
Bolt, Nut and Rivet Works,
Car Axle Works,
Car Wheel Works, and
Car Builders in the United States

ALSO A LIST OF THE

Iron and Steel Works in Canada and Mexico.

This edition of the Directory is an invaluable book of reference for all business men who wish to correspond with iron and steel manufacturers or with iron and steel consumers, forming, in every respect, a COMPLETE GUIDE to the iron and steel works of this country and to the principal works which consume iron and steel.

Sent postpaid, on receipt of price, by

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Illinois	Indiana Louisiana

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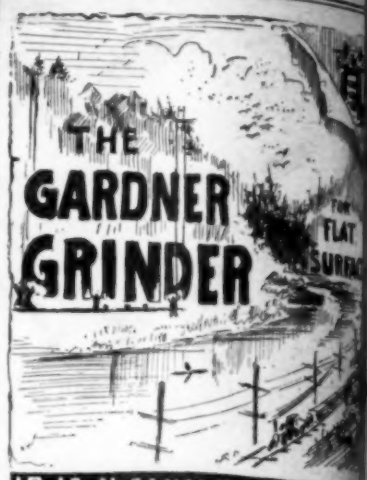

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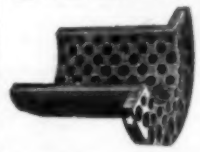
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